

# Symposium 2013



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# **Seafarers International Research Centre Symposium Proceedings (2013)**

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## Foreword

*Professor Helen Sampson*

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The Seafarers International Research Centre (SIRC) was established in 1995. The objective of the Centre was to undertake research relating to seafarers' health, safety, and welfare. Today the Centre undertakes work funded by a variety of bodies and our current most significant funding comes from: the Lloyd's Register Foundation, The TK Foundation, The Nippon Foundation, and Cardiff University. The long-standing nature of the Centre (this year will mark its 18<sup>th</sup> anniversary) has allowed it to build research experience and capacity that is un-paralleled in the field. Academic staff are drawn primarily from Social Science disciplines and some staff (and PhD students) originally worked in the maritime industry as officers. This expertise allows the Centre to undertake work which is not only methodologically robust but also analytically penetrating.

The work undertaken at SIRC is published in a variety of forms which are designed to be accessible to stakeholders and policy makers. Over the years, a range of work has been produced in relation to: regulation; education and training; human resource management; the management of risk; seafarer and vessel casualties; health and welfare; industrial relations; and work processes.

In the course of its development the Centre has built strong connections with policy makers and practitioners. Across the sector organisations have variously commissioned projects, provided 'core-funding', and facilitated research access. Every two years, SIRC holds an international symposium for an invited audience of scholars and stakeholders. At this event we endeavour to provide an overview of some of our recent research findings and an opportunity for participants to discuss these, and their ramifications, in a constructive and friendly environment.

This year the SIRC Symposium will attract more than one-hundred 'delegates' from fifteen countries including China, Malaysia, Bangladesh and the Philippines. Amongst these are representatives from a wide range of industry organisations. Some participants are primarily focussed upon seafarers' welfare and health, some are concerned with safety issues in the

industry, some delegates are concerned directly with the operation of ships, some are focussed on the representation of seafarers, and some attendees are involved in the regulation of the sector. Whatever the reason for taking an interest in our work, however, we hope that the papers presented will be of use, and that our research might impact, if only in small ways, upon policies and practices in the industry, and particularly those which effect seafarers' health, safety and welfare.

## **Programme Overview: Day One**

*Professor Helen Sampson*

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In this year's SIRC symposium we present papers associated with research that has been completed in the last two-years and some new research that has recently begun. The studies presented here, have been variously funded by: the Lloyd's Register Foundation (LRF); the Economic and Social Research Council (ESRC); the Institution of Occupational Safety and Health (IOSH); The TK Foundation, and Cardiff University.

The loss of vessels at sea with associated loss of life, trauma, injury, and damage to the marine environment, remains a global concern. Our first paper therefore reports on a small-scale piece of work undertaken independently at SIRC involving the collation of the findings of accident investigation reports in four countries over a ten-year period. In this process of collation we do not superimpose our own interpretation of events and we make no attempt to attribute accident causation ourselves. We merely group and tally the report findings and consider these figures in relation to accident type. This activity is by no means straightforward as categorising such information is by its nature a subjective process. We have therefore taken steps to make the overall findings more robust by working together to arrive at agreed understandings of the accounts offered by accident investigators and to ensure shared interpretations (across the research team) of the categories that we describe. Our hope is that this may provide a resource for all those who are interested in the issues associated with accidents at sea

The second paper reports on the final stages of a very large-scale research project considering perceptions of risk. This research began in 2004, and was funded by The Lloyd's Register Educational Trust<sup>1</sup>. Here we report on the findings from the conduct of five case studies designed to shed light on why it is that, in spite of the conscious efforts made by some companies to manage safety, incidents that result in harm still occur. The findings indicate that in a context where safety and profit are understood to be competing priorities, seafarers and managers are highly sensitive to the meaning and implications of a huge range of actions taken by companies. These actions impact on perceptions of the commitment of senior company personnel to safety management systems. The implications for companies are

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<sup>1</sup> On 1 March 2013 The Lloyd's Register Educational Trust was assimilated into the Lloyd's Register Foundation. For further information please visit their website [www.lrfoundation.org.uk](http://www.lrfoundation.org.uk).

significant. If they wish to effectively manage health and safety on-board, the findings suggest that, companies have to demonstrate in almost every decision and communication that they prioritise the health and wellbeing of seafarers over broader commercial concerns.

Our third paper introduces a new study at SIRC funded jointly by the Lloyd's Register Foundation, The TK Foundation, and Cardiff University. Inspired by a recognition that communication between ship and shore is essential for the safe operation of vessels, this research examines the barriers to effective interaction between a range of shore-side personnel (from pilots and surveyors to manufacturers of specialist equipment) and sea-staff. Prior to the main data collection phase of the study, we have undertaken a literature 'trawl' in order to identify some of the issues that we should explore with research participants. This has thrown up a variety of interesting areas for further consideration and in this paper we introduce some of these, notably: the impact of workload and specific types of work (in this case paperwork and particularly that associated with port calls); the consequences of vessel inaccessibility for communication; the impact of the characteristics of key personnel and associated issues of legitimacy on interaction; and the impact on language and cultural differences on interaction between shipboard and shore-based personnel.

## **Programme Overview: Day Two**

*Professor Helen Sampson*

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The papers presented on the first day of the symposium had in common a concern with communication. The first paper which presented the collated findings of accident investigators revealed the importance of communication in averting accidents<sup>2</sup>. The second paper described the centrality of communication (both the communication of intended messages and the conveyance of unintended ones) to effective safety management. While the third paper reported on the start of a project which takes as its main concern interaction between seafarers and shore-based personnel.

Today a brief look at the programme might suggest that the papers are less concerned with human behaviour and more concerned with technical issues: mandatory equipment, the regulation of ship emissions, supply chain leverage and the design of vessel accommodation blocks. However this impression would be misleading. Whilst communication is not emphasised in the papers today, the centrality of human beings and their decisions, actions, and understanding remains critical.

In the first paper we report on initial work undertaken with respect to the second of our new studies jointly funded by the Lloyd's Register Foundation, The TK Foundation, and Cardiff University. This project is concerned with why mandatory equipment (which is sometimes of long standing) is not always effectively utilised on-board ship with potentially serious, sometimes fatal, consequences. The literature review that we have undertaken has highlighted some key issues that will be considered in the data collection stages of the research. These include but are not limited to: the impact of design failures on seafarer confidence in using equipment, in training to use it and in maintaining it; the negative impact of unstable crewing practices and high workloads; the negative impact that is associated with requirements to pay frequent attention to equipment that is not seen as performing a useful function on-board; and the negative impact of the fear of breaching regulations.

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<sup>2</sup> Failure in communication was identified by accident investigators as a significant explanatory factor in over a quarter of all the accident investigation reports that we analysed.



In the second paper, Professor Michael Bloor presents findings relating to a study of ship emissions that was funded by the ESRC and completed earlier this year. Here we illustrate how regulations pertaining to sulphur emissions in the Emission Control Areas (ECAs) of the Baltic and English Channel are being enforced. In this we reflect on how such enforcement practices are influencing current compliance as well as how they are likely to impact on future levels of vessel compliance.

The penultimate paper of the symposium derives from a recently completed study that was funded by the Institution of Occupational Safety and Health. The research focussed on the capacity for health and safety management to be positively influenced by organisations at the top end of supply chains by considering the construction and shipping industries. We have previously reported on the preliminary findings of this research in relation to the tanker sector where, it is well-known, that charterers make extensive efforts to influence health and safety outcomes on-board vessels. This paper focuses on fieldwork that was conducted in the rather different context of the container sector where we found the direct influence of charterers to be significantly less. It is interesting to note however, that some charterers in this sector do exert a less direct, but nevertheless positive, influence on the management of safety (in particular) on-board the container vessels that ship their goods.

Finally, Neil Ellis presents work that we have undertaken on the provision of shipboard accommodation, facilities, and amenities. Here we consider the experiences that seafarers have had of shipboard accommodation (aboard their latest/current vessel) and the related provision of a range of facilities/amenities. We are particularly interested to consider the likely impact of such provision on seafarers' health and wellbeing which in turn, self-evidently, impacts on their performance and the safe passage of vessels. Our data indicate that amongst other things: seafarers' sleep is often disrupted by noise and vibration; that seafarers lack control over important features of their environment (such as light levels in their cabin) which can affect their overall wellbeing; that seafarers may not find their accommodation spaces restorative in the face of stress and fatigue which may impact on their health and performance; and that seafarers' needs for interaction, both on-board and with those remaining ashore, are not being adequately met, leading to the potential for a variety of negative outcomes for seafarers and their health and wellbeing.

We very much hope that you find the papers presented at the 2013 SIRC Symposium to be of interest and use.

# **Behind the Headlines? An Analysis of Accident Investigation Reports**

*Lijun Tang, Iris Acejo, Neil Ellis, Nelson Turgo & Helen Sampson*

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## **Abstract**

This paper reports on an analysis of 319 accident investigation reports published over a ten-year period by four maritime authorities. In doing so it highlights the immediate and contributory causes identified by the report authors and aggregates these to create an impression of the major causes of accidents as identified by investigators over a decade. The aggregation and analysis suggest that non-seafarer related factors constitute more than one quarter of all the causes identified in the reports. In particular, third party deficiencies, poor design, and technical failure are prominently identified as causes of ‘fire and explosion’ and ‘lifeboat’ accidents. In ‘grounding’ and ‘collision, close quarter & contact’ accidents, causes such as ‘poor judgement/operation’, ‘failure in communication/coordination’, and ineffective/inappropriate use of technology stand out. Of greatest overall concern to accident investigators was ‘inadequate risk management’ and ‘failure in communication’ despite the implementation of the ISM Code. In addition to the aggregate analysis presented, the paper offers illustrative examples from specific accident investigation reports whilst acknowledging the complexities of accident causation and the dangers of oversimplification in the assignment of accident cause.

## **Introduction**

It is evident that maritime safety has improved in the last century as a result of a combination of factors including: technological advancement; better training; and regulatory development (Allianz, 2012). However, despite such improvement seafaring remains a relatively dangerous occupation (Hansen, 1996; Roberts and Marlow, 2005 Borch et al., 2012).

One way to improve safety at sea is to ‘learn’ from past accidents. For this purpose, maritime authorities around the world invest a considerable amount of resource in investigating accidents and producing reports. Each report offers a detailed account of what took place and attempts to identify all the relevant factors and contributory causes. While they provide rich information, meticulous analysis and detailed insight, such accident reports are generally read as isolated documents and therefore fail to shed light on general patterns or trends. To identify general patterns and identify more general lessons from accidents, it is helpful therefore to consider such documents ‘en masse’ and to systematically aggregate their findings as far as is reasonable. This is the aim of this paper, which reports on an analysis of

319 accident investigation reports published over a ten-year period<sup>1</sup> (from 2002 to 2011). Among these 319 accidents, 148 were investigated by the (UK) Maritime Accident Investigation Branch (MAIB), 110 by the Australian Transportation Safety Board (ATSB), 43 by Maritime New Zealand, and 18 by the (US) National Transportation Safety Board (NTSB)<sup>2</sup>.

## Method of analysis

Each report was given a first reading by an individual member of the research team (of five). All elements of the report were read in this initial phase (synopses and findings/conclusions). The synopsis provides an overview of an accident, and the findings/conclusion gives the causes and contributory factors that led to the accident. While reading, the researcher summarised detailed causes and contributory factors into abstract ‘categories’, which were used to code the causes of each accident. In this process, categories were refined and collapsed as required. At the end of the process, twenty-three categories had been arrived at, and these went on to be used throughout the analysis. As such, the categories are fully grounded in data, i.e. the accident investigation reports, rather than being adopted from any existing and pre-defined model. The scheme will be explained in the next section.

In the next stage of the research, four researchers were divided into two groups. Each group was tasked to analyse half of the 319 accident reports and categorise the *immediate causes* and *contributory causes* of each accident using the above mentioned scheme. *Immediate causes* refer to causes that directly lead to the accidents at the end of error chains, while *contributory causes* are defined as those that either lead to the immediate causes or create conditions for immediate/contributory causes to arise. The researchers read the full content of each report and categorised the causes individually. After both the researchers in a pair had finished a number of reports (five or ten), they came together to check each other’s categorisation. If there were differences in their assessment they would discuss these until they arrived at a consensus. A fifth researcher was available to assist in interpretation where agreement could not easily be arrived at. The research pairs would then move on to analyse the next five or ten reports individually. In the end, the two groups combined their results into

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<sup>1</sup> Only accidents involving vessels of 1,000 GRT or above are included.

<sup>2</sup> NTSB published 41 accident reports online during this ten-year period, and only 18 of them involved vessels of 1,000 GRT or above.

one dataset for statistical analysis using the Statistical Package for the Social Sciences (SPSS).

### **Categorisation scheme and brief explanation**

#### Accident types

The accidents were categorised into five types : 1) collision, close quarter & contact, 2) grounding, 3) fire and explosion, 4) lifeboat accident, and 5) other, such as crane failure, man overboard, cargo loss, engine room flooding, trip and fall, parting of mooring lines, oil spill, etc (see Table 1).

*Table 1: Frequencies of different types of accidents*

|                                    | <b>Frequency</b> | <b>Percent</b> |
|------------------------------------|------------------|----------------|
| Collision, close quarter & Contact | 99               | 31.0           |
| Grounding                          | 62               | 19.4           |
| Fire & explosion                   | 33               | 10.3           |
| Lifeboat                           | 13               | 4.1            |
| Other                              | 112              | 35.1           |
| <b>Total</b>                       | <b>319</b>       | <b>100.0</b>   |

Accident ‘causes’ were categorised into the following groups:

1. Alcohol/drug: under the influence of alcohol or drug.
2. Fatigue.
3. Under-manning.
4. Distraction: watch keepers are distracted by phone-calls, paperwork, music, or other activities irrelevant to navigation
5. Inadequate lookout.
6. Unsafe speed.
7. Ineffective use of technology: situations in which technology/equipment is not used to its full potential
8. Inappropriate use of technology: overdependence on, or misuse of, technology/equipment.

9. Failure in communication/coordination: including ineffective bridge/engine room resource management, ineffective co-ordination between crew members during ship operations (Note: communication failure involving a pilot is singled out).
10. Inadequate training/experience.
11. Inappropriate/ineffective maintenance.
12. Inadequate risk management: including inadequate safety management system (SMS) in the company or on-board, no clear procedures, etc. (Note: maintenance issue is singled out).
13. Poor emergency response.
14. Poor judgement/operation: including poor judgements/operations of officers or unexplained mistakes by ship operators.
15. Overloading: cargo or passenger overloading.
16. Rule violation: regulations, rules, or procedures are violated.
17. Ineffective communication between pilot/master.
18. Pilot error/mishandling.
19. Lack of manufacturer guidance: manuals are unclear, not up to date, or contain wrong information.
20. Poor design.
21. Third party deficiency: involving third parties other than pilots and manufacturers. Examples include: regulatory bodies that do not have relevant rules, port authorities that do not provide sufficient navigational aids, erroneous chart information, mistakes by contractors.
22. Weather/other environmental factors: including bad weather, shallow water, strong current, etc.
23. Technical failure

These causes can be further divided into two big groups: causes not directly related to seafarers/ship operators (18-23), and causes directly related to seafarers/ship operators (1-17).

## Findings

### Overall picture

Looking at the immediate causes, ‘poor judgement/operation’ was the most frequently found cause of accidents (18.2%), followed by ‘technical failure’ and ‘inadequate look out’ which accounted for 12.5% and 11.9% of causes respectively. Two causes were identified that concern communication specifically: ‘failure in communication/coordination’ and ‘communication problem between captain/pilot’. Combined together as a new category of ‘failure in communication’ these constitute the fourth highest immediate cause of accidents at sea (9.4% in total). The frequencies of all causes are summarised in Table 2. Overall, causes which were identified as being directly related to seafarers/ship operators were found 260 times, and causes not directly related to seafarers/ship operators were identified 118 times. This indicates that in the judgement of the accident investigators concerned, non-seafarer related factors directly accounted for around one third of accidents (however note the complexities here as identified by Ghanem, 2009).

*Table 2: Immediate causes*

| <b>Immediate causes</b>                     | <b>No. of cases</b> | <b>Percentage of cases</b> |
|---------------------------------------------|---------------------|----------------------------|
| Poor judgement/operation                    | 58                  | 18.2                       |
| Technical failure                           | 40                  | 12.5                       |
| Inadequate lookout                          | 38                  | 11.9                       |
| Inadequate risk management                  | 29                  | 9.1                        |
| Inappropriate/ineffective maintenance       | 25                  | 7.8                        |
| Inadequate training/experience              | 24                  | 7.5                        |
| Third party deficiency                      | 24                  | 7.5                        |
| Failure in communication/coordination       | 22                  | 6.9                        |
| Weather/other environmental factors         | 20                  | 6.3                        |
| Pilot error/mishandling                     | 19                  | 6                          |
| Rule violation                              | 16                  | 5                          |
| Poor design                                 | 13                  | 4.1                        |
| Fatigue                                     | 12                  | 3.8                        |
| Communication problem between captain/pilot | 8                   | 2.5                        |
| Alcohol/drugs                               | 7                   | 2.2                        |
| Unsafe speed                                | 7                   | 2.2                        |
| Inappropriate use of technology/equipment   | 6                   | 1.9                        |
| Overloading                                 | 4                   | 1.3                        |
| Ineffective use of technology/equipment     | 3                   | 0.9                        |
| Lack of manufacturer guidance               | 2                   | 0.6                        |
| Distraction                                 | 1                   | 0.3                        |

In terms of contributory factors, ‘inadequate risk management’ was the most prominent contributing factor by quite a margin (36.7%). The next most frequent contributory factor was ‘third party deficiency’ (21.9%), followed by ‘inadequate training/experience’ (19.7%), and ‘failure in communication/coordination’ (18.5%). If we combine ‘failure in communication/coordination’ and ‘communication problem between captain/pilot’ into ‘failure in communication’, then this combined cause constitutes the second highest contributory cause of accidents in this analysis (22.6% in total). Thus ‘failure in communication’ featured prominently both in relation to immediate and contributory causes. All contributory factors are summarised in Table 3. Overall causes directly related to seafarers/ship operators appeared 555 times, and causes not directly related to seafarers/ship operators appeared 186 times. Around one quarter of contributory causes were therefore assessed, by the investigators concerned, to be non-seafarer related.

*Table 3: Contributory causes*

| <b>Contributory causes</b>                  | <b>No. of cases</b> | <b>Percentage of cases</b> |
|---------------------------------------------|---------------------|----------------------------|
| Inadequate risk management                  | 117                 | 36.7                       |
| Third party deficiency                      | 70                  | 21.9                       |
| Inadequate training/experience              | 63                  | 19.7                       |
| Failure in communication/coordination       | 59                  | 18.5                       |
| Ineffective use of technology/equipment     | 49                  | 15.4                       |
| Weather/other environmental factors         | 44                  | 13.8                       |
| Rule violation                              | 41                  | 12.9                       |
| Poor design                                 | 33                  | 10.3                       |
| Fatigue                                     | 32                  | 10                         |
| Poor judgement/operation                    | 31                  | 9.7                        |
| Inappropriate/ineffective maintenance       | 28                  | 8.8                        |
| Under- manning                              | 27                  | 8.5                        |
| Poor emergency response                     | 25                  | 7.8                        |
| Distraction                                 | 22                  | 6.9                        |
| Inappropriate use of technology/equipment   | 20                  | 6.3                        |
| Inadequate lookout                          | 17                  | 5.3                        |
| Lack of manufacturer guidance               | 16                  | 5                          |
| Technical failure                           | 15                  | 4.7                        |
| Communication problem between captain/pilot | 13                  | 4.1                        |
| Unsafe speed                                | 8                   | 2.5                        |
| Pilot error/mishandling                     | 8                   | 2.5                        |
| Overloading                                 | 3                   | 0.9                        |

### Immediate and contributory causes of different types of accidents

It is likely that different types of accidents (for example grounding and fire) are associated with different perceived causes. We therefore gave consideration to the different types of accidents to identify any such patterns.

#### *Collision, close quarter & contact accidents*

In relation to collision close quarter & contact accidents, ‘inadequate lookout’ and ‘poor judgement/operation’ were the two most common immediate causes identified by accident investigators: while the former was featured in 35.4 per cent of cases, the latter was identified in 26.3 per cent. Two other prominent immediate causes emerged: ‘pilot error/mishandling’ (13.1%) and ‘rule violation’ (12.1%) (see Figure 1a).

‘Failure in communication/co-ordination’ was also identified as an immediate cause of collision, close quarter & contact accidents. Not only was this identified as directly leading to such accidents (in 10.1% of cases see Figure 1a), it also featured as a contributory cause that was identified in a high number of cases (26.3% see Figure 1b).

Use of technology/equipment featured prominently in the accounts of accident investigators as a contributory cause. ‘Ineffective use of technology’ and ‘inappropriate use of technology’ were identified in 31.3 per cent and 11.1 per cent cases respectively. In such cases technology had generally not been used to its full potential or had been misused in ways which negatively affected watchkeeping and/or ship operations and resulted in collisions, close quarters, or contacts with fixed objects (see Figure 1b). ‘Inadequate training/experience’ and ‘third party deficiency’ were also highlighted by accident investigators and each of these causes feature in 20 per cent of all cases (see Figure 1b).



Figure 1a: Immediate causes of collision, close quarter & contact accidents

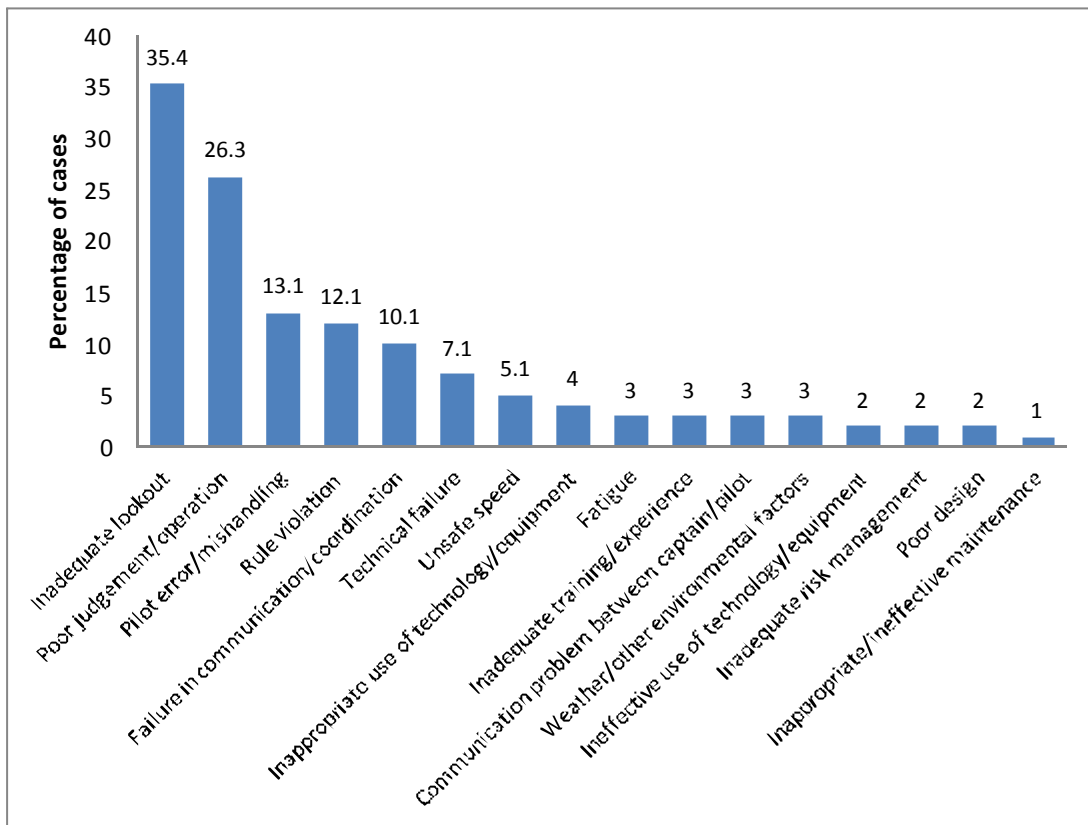
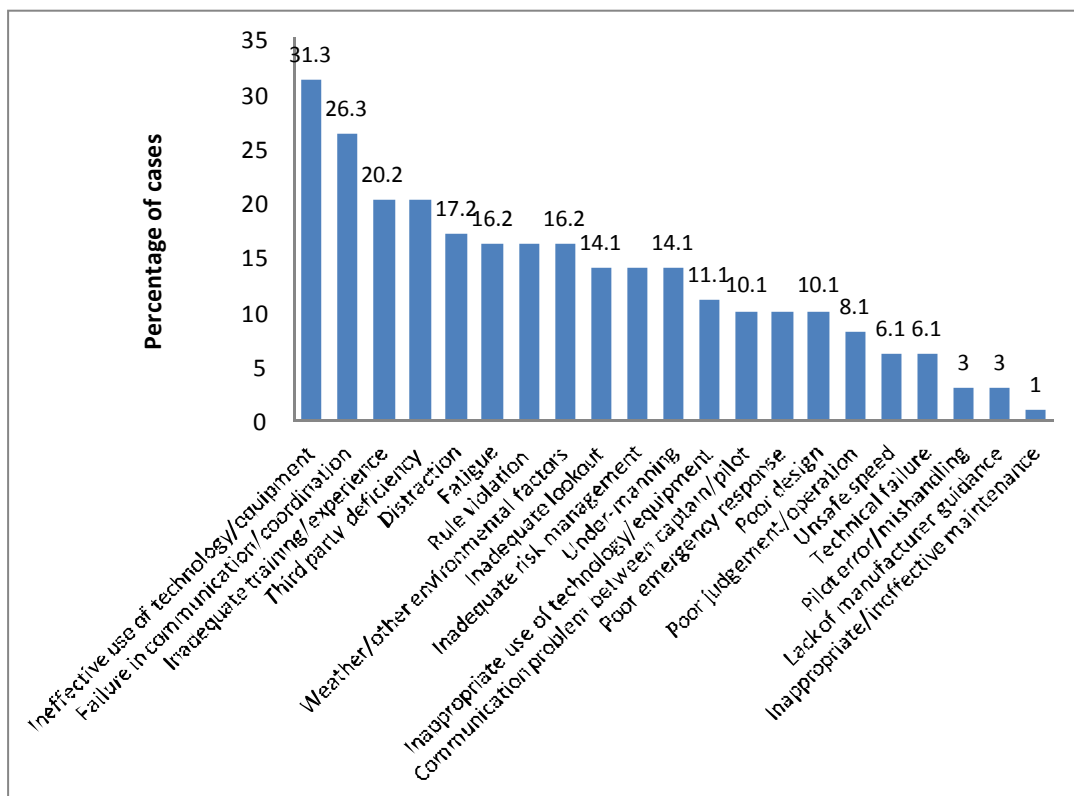


Figure 1b: Contributory causes of collision, close quarter & contact accidents



The case of the collision between the *Atlantic Mermaid* and *Hampoel* in June 2001 illustrates some of these findings. In this incident the overtaking vessel, *Atlantic Mermaid*, failed to stay clear of the slower vessel *Hampoel* which similarly failed to take action to avoid a collision once it was apparent that a high risk of such collision existed. At the time of the collision *Atlantic Mermaid* was ballasting the forepeak and the trim and vessel's ballast condition produced a blind spot from the bridge of around 50-70 metres. The second officer and helmsman who were on the bridge with the Master were attending to non-watchkeeping duties. This rendered the Master, who had a headache, was new to the company, had only recently joined the vessel, and may have been fatigued, the sole watchkeeper and lookout. In addition the radars on the vessel were reported to be substandard. The report notes that:

The pilot who had recently been on the vessel described the radars as “appalling” and “difficult to use”. He said that the overall quality of radar picture was “poor” and that he had to work on longer ranges than he normally would to obtain a clear picture. (MAIB 2002a:20)

In relation to *Atlantic Mermaid* the MAIB made the following recommendations to Elmira Shipping and Trading:

1. Ensure that all of its vessels are fitted with radars which are in good working order, such that a proper radar watch can be kept.
2. Ensure that identified deficiencies to navigational equipment on its vessels are promptly and effectively rectified.
3. Ensure that there are sufficient bridge watchkeepers on its vessels at all times.
4. Ensure that the ability to keep a proper watch is not constrained by:
  - Additional tasks to watchkeeping
  - Lack of movement for all round visibility
  - Fatigue
  - Reduced vigilance (MAIB 2002a:28)

### *Grounding*

‘Failure in communication/co-ordination’ was the most prominent cause identified by accident investigators in grounding incidents. This was suggested to have immediately led to groundings in 14.5 per cent of cases, and it was said to have contributed to the grounding of vessels in 33.9 per cent of cases (see Figure 2a and 2b). Other immediate causes of

groundings were found to be ‘fatigue’ (an immediate cause in 11.3% of cases), ‘poor judgement/operation’ (11.3%), weather conditions (11.3%) and technical failure (11.3%). While ‘inadequate risk management’ was the most visible contributory cause of grounding incidents, failure in communication/co-ordination (33.9%), and use of technology/equipment also appeared as a noteworthy contributory factors here. ‘Ineffective use of technology’ and ‘inappropriate use of technology’ were identified in 25.8 per cent and 12.9 per cent of cases respectively.

In terms of ‘third party’ causes of groundings pilots were most prominent in collision, close quarter & contact accidents and also in groundings. ‘Pilot error/mishandling’ directly led to 13.1 per cent of the first type of accidents (see Figure 1a) and slightly less than ten per cent of grounding incidents. Further to this, ‘communication problem between captain/pilot’ was considered by accident investigators to be directly responsible for just over eight per cent of groundings and three per cent of collisions.

*Figure 2a: Immediate causes of groundings*

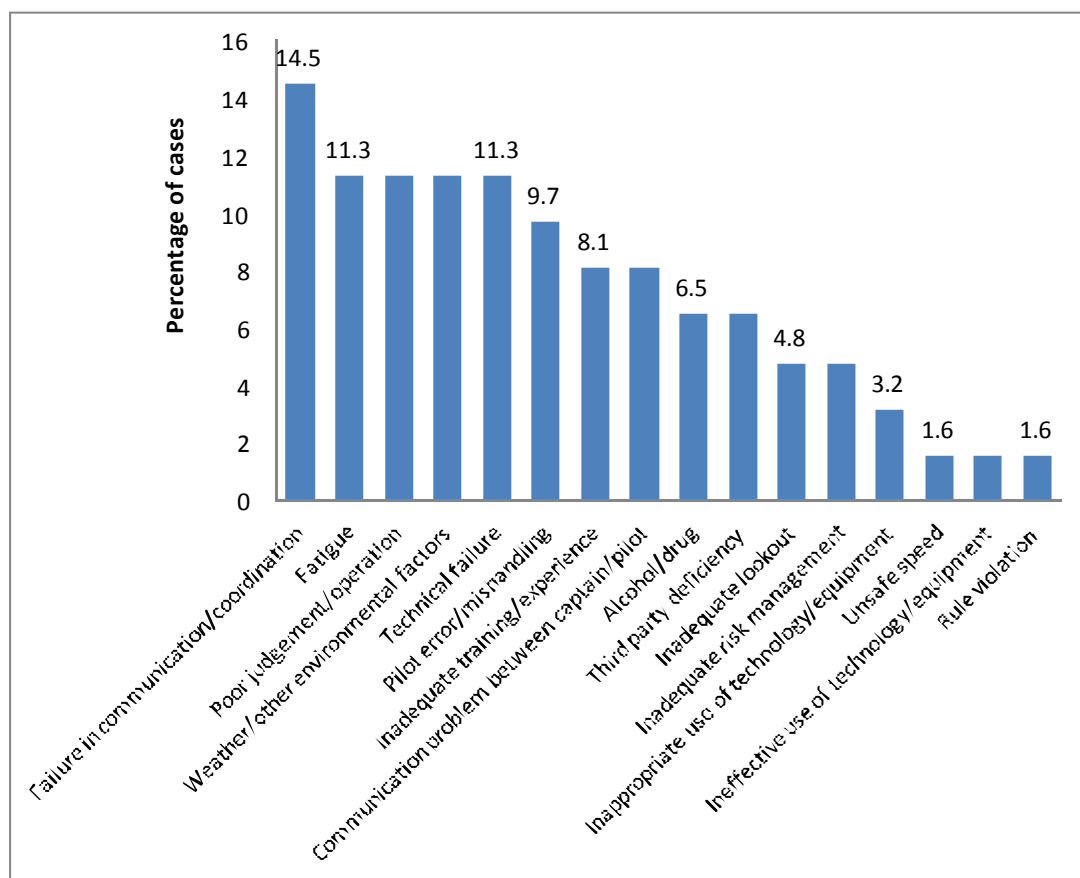
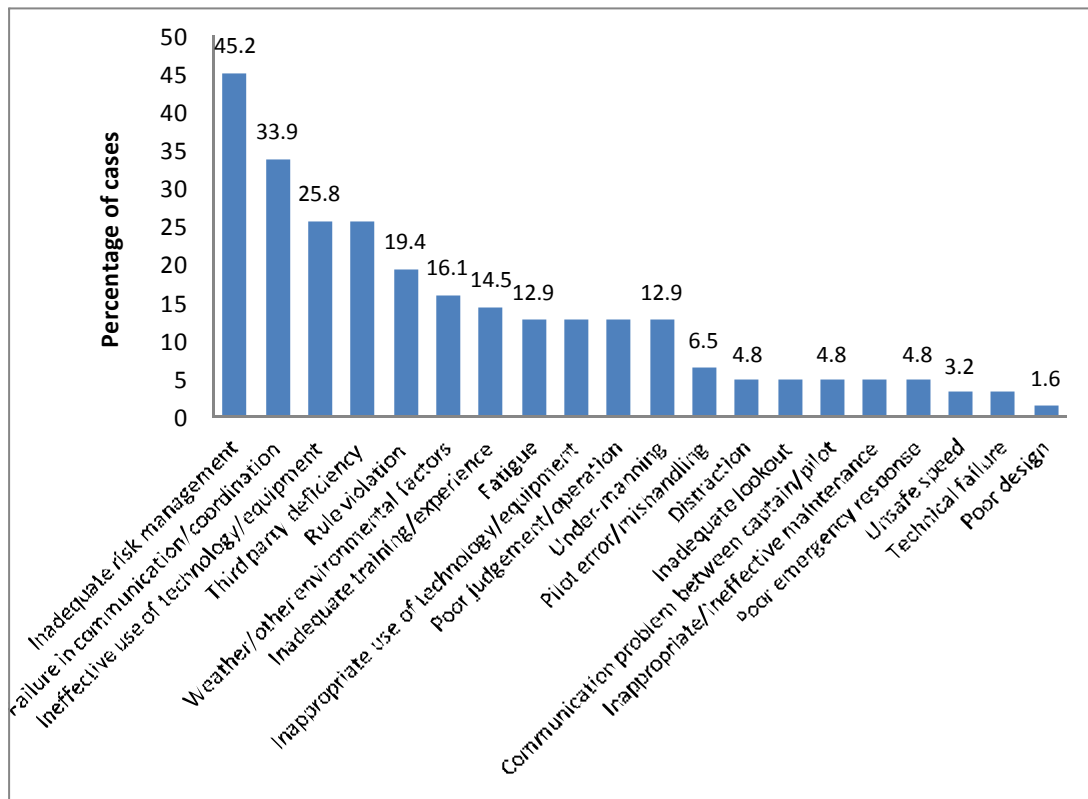


Figure 2b: Contributory causes of groundings



The case of the British-flagged general cargo vessel *MV Lerrix* which grounded in the Baltic Sea in October 2005, illustrates some of the factors which were commonly identified by inspectors when reporting on groundings. In this case several factors were identified by inspectors to have contributed to the incident. The master was fatigued as a consequence of the 6-on/6-off watchkeeping system that was in place, the watch alarm was not functioning and the master was alone on the bridge. The accident investigation report made reference to a study commissioned by the Chief Inspector of Marine Accidents in 2003. This study considered 23 vessels involved in groundings and concluded that:

Nearly 50% (11 cases) occurred between 0000 and 0600 of which fatigue was considered a contributory factor in nine of the cases.

In eight of those nine fatigue related accidents, the vessels:

- Carried only two watchkeeping officers.
- Had not posted a lookout.
- Were steering by autopilot.
- Were not fitted with, or were not using a watch alarm.
- Had an unaccompanied watchkeeper who had fallen asleep. (MAIB 2006:28)

## *Lifeboats*

In relation to lifeboat incidents, ‘inappropriate/ineffective maintenance’ (38.5%), ‘inadequate training/experience’ (23.1%), and poor judgement/operation (23.1%) were identified most frequently by accident investigators as immediate causes of accidents, and ‘inadequate training/experience’ (38.5%) was noteworthy as a contributory cause (see Figure 3a and 3b respectively). Furthermore, ‘poor design’ and ‘third party deficiency’ were also identified relatively frequently by accident investigators as contributing to accidents involving lifeboats as both an immediate and a contributory cause.

*Figure 3a: Immediate causes of lifeboat accidents*

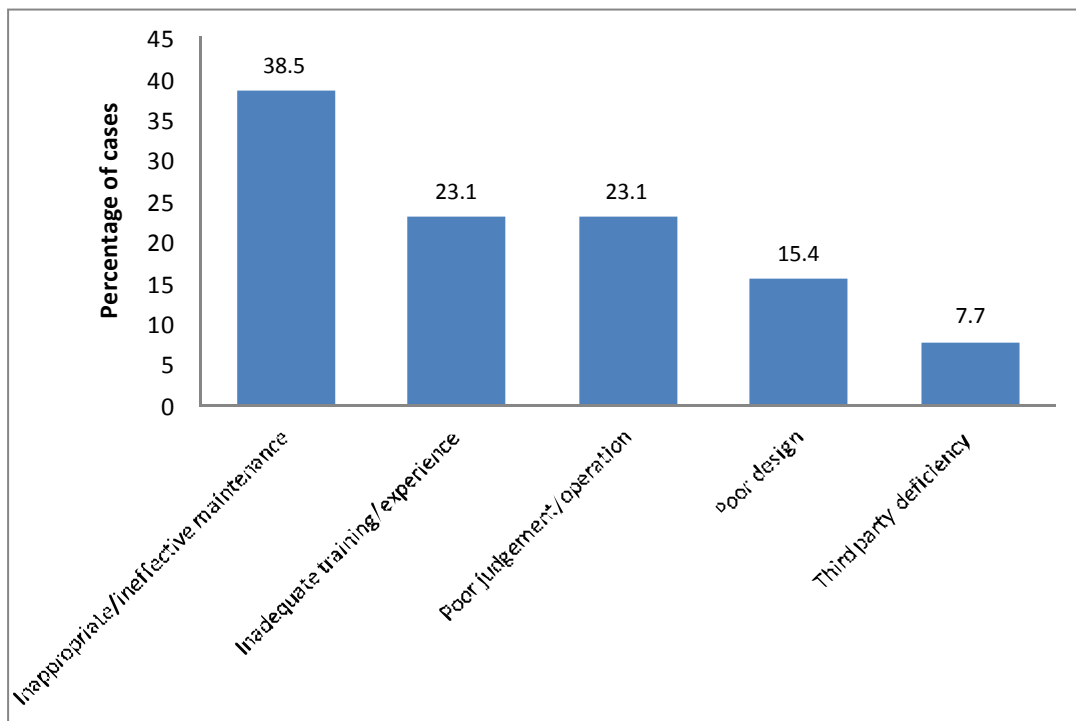
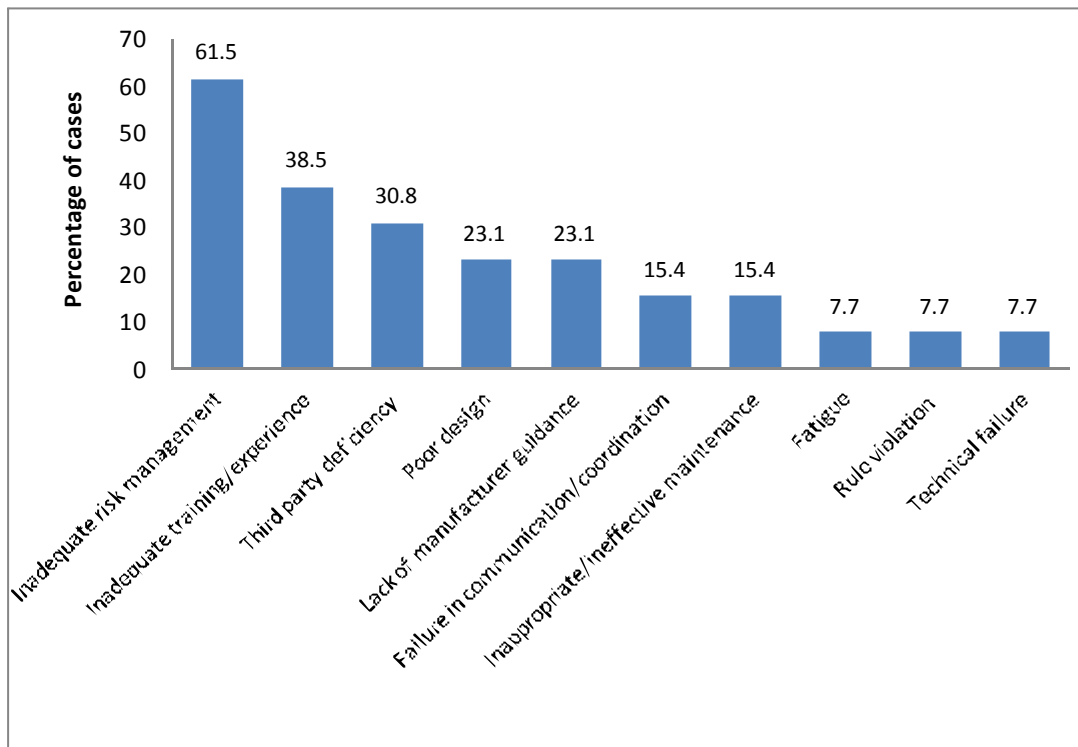


Figure 3b: Contributory causes of lifeboat accidents



The case of the Turkish bulk carrier *Gulser Ana* is illustrative of the kinds of issues which were most frequently identified by accident investigators in relation to lifeboat accidents. In October 2001, the *Gulser Ana* was detained in Belfast harbour by MCA inspectors and following the detention two members of the crew engaged in efforts to rectify poor maintenance of the starboard lifeboat whilst it was on the water. Once satisfied that their task was complete the boat was hoisted to embarkation level where it remained suspended by its falls. The chief officer of the vessel boarded the lifeboat, joining the two crewmembers already on-board, to inspect the work. Within less than a minute the forward hook released dropping the forward end of the lifeboat and throwing the three seafarers into the water. The chief officer was rendered unconscious and was not wearing a lifejacket, however, his fellow crewmen (who were in lifejackets) were able to pull him to the surface of the water and keep him afloat until they were picked up by the pilot launch.

The report describes failures in maintenance, understanding, and risk management, and states that:

The following evidence, found on-board, indicated that the vessel's operator had shied away from its responsibilities to ensure that *Gulser Ana*'s crew maintained and operated the lifeboat hook release mechanism safely:

- Nobody on-board had been trained in its use.
- The manufacturer's manual was written in poor English, which was difficult even for a native speaker of English to understand.
- None of the manuals were written in the working language of the crew.
- There were no written procedures or plans to ensure that repairs were undertaken safely.
- No formal risk assessment had been carried out on the work to be done, and there was no procedure in place to require such an assessment to be completed. (MAIB 2002b:15)

In relation to the manual the report further adds that the manual was not simply deficient but was in fact highly misleading. The investigators state that:

Much of that described in the manual was unclear or misleading. For example, it read "but the releasing handling does not operate other than after the boat was waterborne". On the contrary, this handle did operate the release mechanism with the lifeboat out of the water. (MAIB 2002b:15)

### *Fire and Explosion*

Investigators seeking to understand the causes of fire and explosion raised concern with 'technical failure' and 'third party deficiency' as the most frequent immediate causes in terms of these kinds of incidents (see Figure 4a). Inadequate risk management was the most frequently found contributory cause in terms of fire and explosion and this was identified in a large number of cases (51.5%, see Figure 4b). In addition, maintenance and training and emergency response were also issues reflected in fire and explosion accident reports. 'Inappropriate/ineffective maintenance' was identified as an immediate cause in 12.1 per cent of cases and as a contributory cause in 24.2 per cent of cases. 'Inadequate training/experience' was identified as an immediate cause in just over nine per cent of cases and as a contributory cause in 21.2 per cent of cases. Poor emergency response was as a contributory factor in nearly a quarter of all incidents (24.2%).

Figure 4a: Immediate causes of fires and explosions

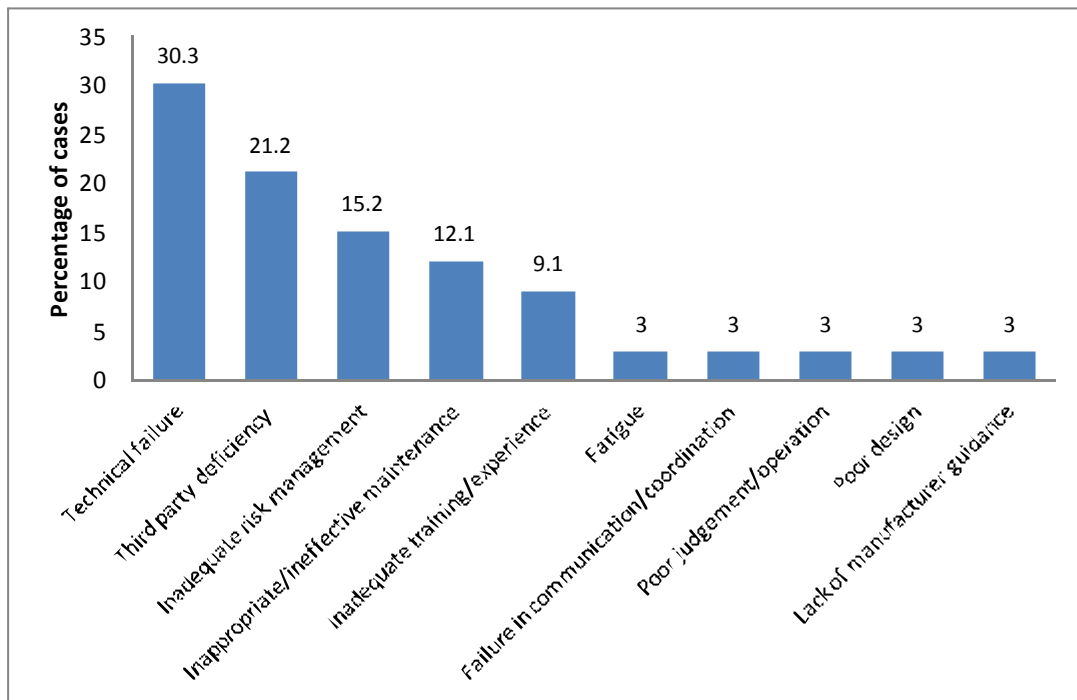
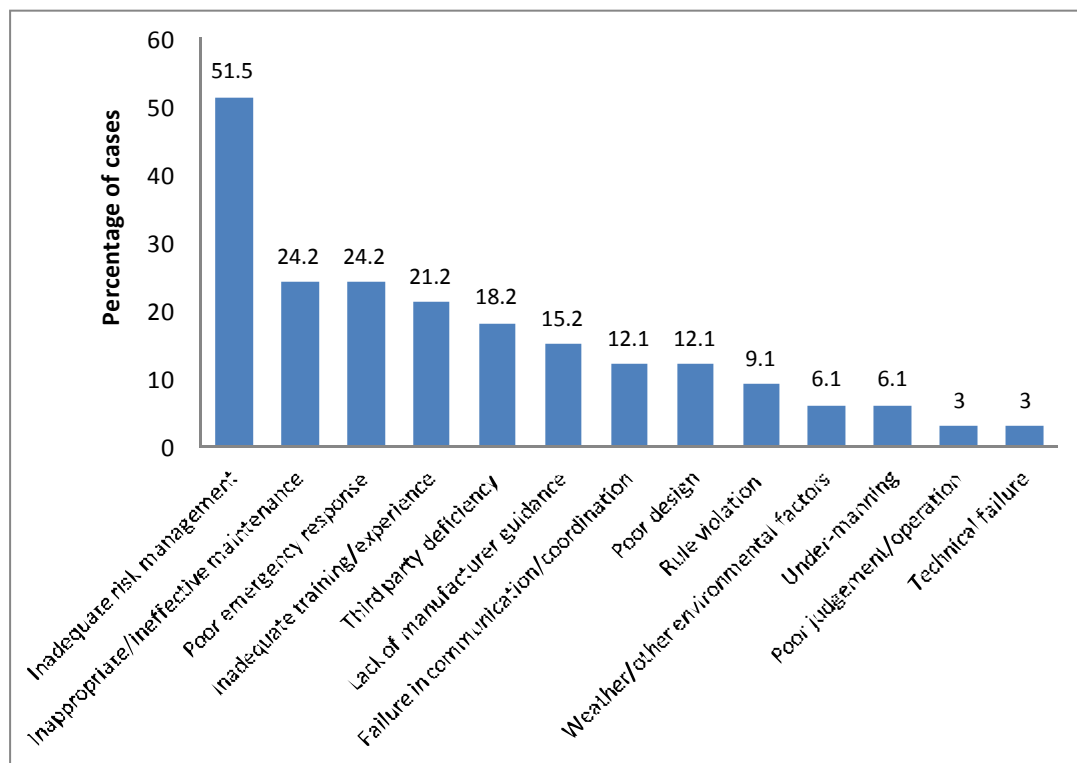


Figure 4b: Contributory causes of fires and explosions





The case of a fire in the engine room of the Cypriot-registered cruise vessel *Calypso* highlights some of these factors. The fire was caused by the failure of a low pressure fuel pipe flange which in the absence of a guard sprayed fuel onto the adjacent turbocharger (and possibly exhaust piping) immediately resulting in the fire. The engine manufacturer had become aware of the weakness in the flange design and had issued a technical bulletin recommending modifications to such flanges. However, aboard *Calypso* these modifications had never been made. Subsequent attempts to fight the fire were deeply flawed and the report suggests that it was fortunate that fatalities did not occur:

The fire was intense, and the subsequent fire-fighting response highlighted flaws in the knowledge, experience and training of some of the ship's senior officers. Those on-board believed that the fire had been successfully extinguished by the quick use of the fixed CO<sub>2</sub> fire smothering system. The fire had, in fact, died down mainly as a result of fuel starvation due to the quick action of the watchkeeping engineer officer. Those in charge of the fire-fighting response did not appear to follow recognised good practice. The attempt to release CO<sub>2</sub> was made from the CO<sub>2</sub> room, and not from the appropriate remote operating station, from where mistakes were less likely to have occurred. The person tasked to release the CO<sub>2</sub> was not the person designated on the muster list. On a number of separate occasions soon after they thought CO<sub>2</sub> had been released, senior officers re-entered the engine room without the proper equipment or back-up and with the consequent risk of allowing air to feed the fire.

The officer, who had attempted to release the CO<sub>2</sub>, had mistaken timer bottles for pilot cylinders and it subsequently transpired that, unbeknown to anyone on-board, no CO<sub>2</sub> had been released in the immediate aftermath of the fire. The CO<sub>2</sub> system was not checked and made secure after the fire, and it had been left in a dangerous condition with distribution and other valves open and all the cylinders still full. During the investigation into the cause of the fire, after the vessel's arrival in Southampton, CO<sub>2</sub> from a bank of cylinders was accidentally released into the engine room. In the event, three crew were lucky to escape without loss of life or serious injury. (MAIB 2007:1).

### *Other accidents*

Whilst it may not make sense to attempt to identify patterns in relation to the varied category 'other accidents' poor judgement/operation and inadequate risk management were frequently identified by investigators as an immediate cause (inadequate risk management was identified in 17.0% of cases as an immediate cause, and in 44.6% as a contributory cause). The causes are shown in Figure 5a and 5b).

Figure 5a: Immediate causes of other accidents

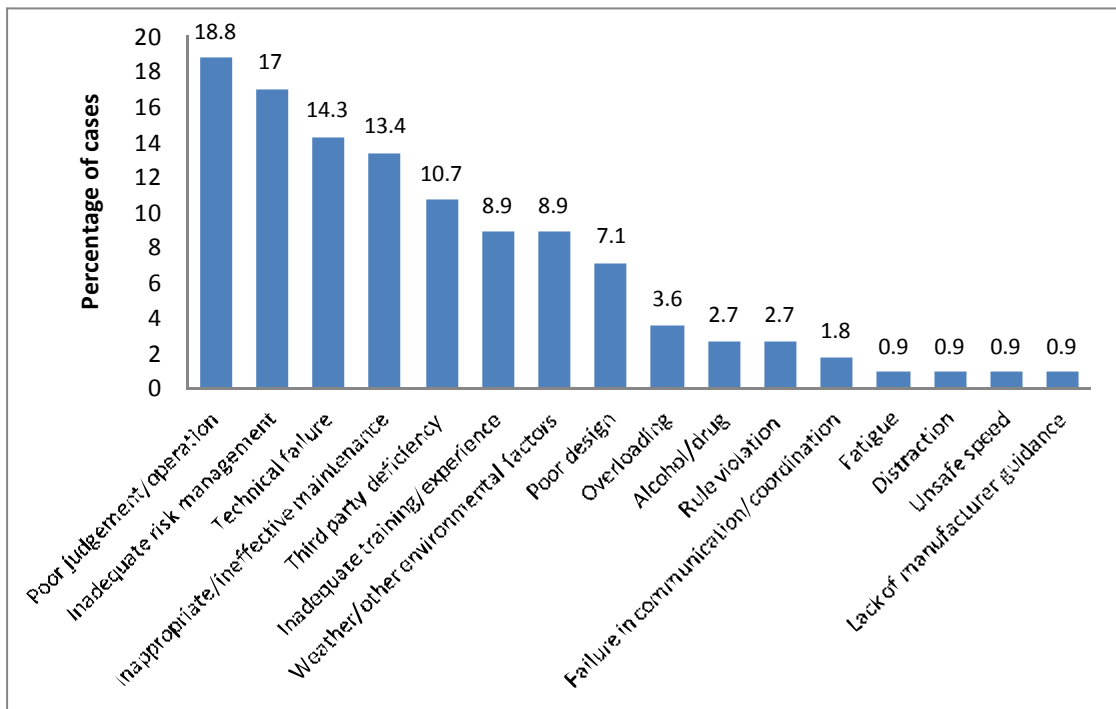
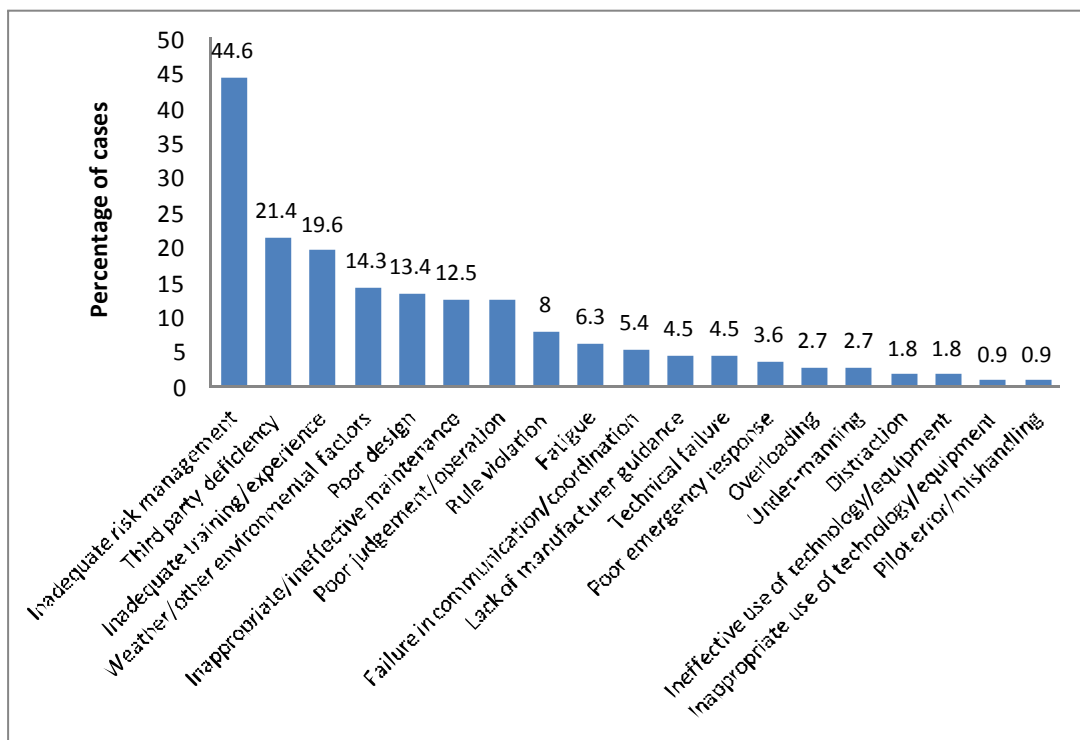


Figure 5b: Contributory causes of other accidents



### Combined causes of accidents

In combining the immediate and contributory causes together the overall picture (see Table 4) that emerges suggests that in descending order the following factors were identified by accident investigators most frequently: inadequate risk management; third party deficiencies; poor judgement/operation; inadequate training/experience; failure in communication/coordination; weather/environmental factors; rule violations; inadequate lookout; technical failure; inappropriate/ineffective maintenance; ineffective use of technology/equipment; poor design; and fatigue.

*Table 4: Overall Picture (all causes combined)*

| <b>Causes</b>                               | <b>No. of cases</b> | <b>Percentage of cases</b> |
|---------------------------------------------|---------------------|----------------------------|
| Inadequate risk management                  | 146                 | 45.8                       |
| Third party deficiency                      | 93                  | 29.2                       |
| Poor judgement/operation                    | 89                  | 27.9                       |
| Inadequate training/experience              | 85                  | 26.6                       |
| Failure in communication/coordination       | 81                  | 25.4                       |
| Weather/other environmental factors         | 64                  | 20.1                       |
| Rule violation                              | 57                  | 17.9                       |
| Inadequate lookout                          | 55                  | 17.2                       |
| Technical failure                           | 55                  | 17.2                       |
| Inappropriate/ineffective maintenance       | 53                  | 16.6                       |
| Ineffective use of technology/equipment     | 52                  | 16.3                       |
| Poor design                                 | 46                  | 14.4                       |
| Fatigue                                     | 44                  | 13.8                       |
| Pilot error/mishandling                     | 27                  | 8.5                        |
| Under- manning                              | 27                  | 8.5                        |
| Inappropriate use of technology/equipment   | 26                  | 8.2                        |
| Poor emergency response                     | 25                  | 7.8                        |
| Distraction                                 | 23                  | 7.2                        |
| Communication problem between captain/pilot | 21                  | 6.6                        |
| Lack of manufacturer guidance               | 18                  | 5.6                        |
| Unsafe speed                                | 15                  | 4.7                        |
| Alcohol/drugs                               | 7                   | 2.2                        |
| Overloading                                 | 7                   | 2.2                        |

Again, examining the five types of accidents individually in terms of combined causes (the graphs of combined causes of each type of accidents are provided in the Appendix), we observe the following patterns :

- ‘Inadequate risk management’ was identified as the most frequent cause in relation to four types of accidents: fire and explosion (66.7%), other accidents (61.6%), lifeboat accidents (61.5%), and grounding (50%).
- ‘Third party deficiency’ was more prominent in fire and explosion (39.4%), lifeboat accidents (38.5%), groundings (32.3%), and other accidents (31.3%).
- ‘Poor judgement/operation’ was a more commonly identified feature of collision, close quarter & contact accidents (34.3%), and other accidents (31.3%).
- ‘Inadequate training/experience’ was identified as a cause of lifeboat accidents (61.5%) and fire and explosion (30.3%).
- ‘Failure in communication/coordination’ was identified by accident investigators more frequently in relation to groundings (48.4%) and collision, close quarter & contact accidents (36.4%).
- ‘Weather/environmental factors’ were seen by investigators to have contributed more often to groundings (27.4%) and other accidents (23.2%).
- ‘Rule violations’ were regarded as more prominent in collision, close quarter & contact accidents (28.3%), and groundings (21%).
- ‘Inadequate lookout’ was understandably identified as a major cause of collision, close quarter & contact accidents (49.5%).
- ‘Technical failure’ was identified in fire and explosion (33.3%).
- ‘Inappropriate/ineffective maintenance’ was frequently identified as a cause in relation to lifeboat accidents (53.8%), and fire and explosion (36.4%).
- ‘Ineffective use of technology/equipment’ was identified as a problem in collision, close quarter & contact accidents (33.3%), and groundings (27.4%).
- ‘Poor design’ was a factor identified by investigators in relation to lifeboat accidents (38.5%).
- ‘Fatigue’ featured more frequently as an explanation for groundings in accident investigation reports (24.2%).

## **Conclusions**

Despite the positive improvements in maritime safety over the years, the safety of shipping is still an area giving rise to concern. This paper has attempted to offer insight into past accidents by analysing and aggregating the findings of 319 accident investigation reports

produced by four maritime authorities over a ten-year period. While all such reports are social constructions and as a result, in their production, they are subject to a number of influences, they nevertheless provide us with valuable information about the kinds of factors which have been previously seen by accident investigators as underpinning accidents at sea. The findings indicate that in many cases the factors that are identified by investigators as underlying accidents at sea fall outside the influence of seafarers (a third of incidents could be considered in this analysis to be 'non-seafarer related'). For example, 'third party deficiency', 'poor design', and 'technical failure' were prominent causes identified in relation to fire and explosion and lifeboat accidents. In the judgement of accident investigators seafarers were implicated more frequently in relation to groundings and collision and close quarter & contact accidents, where 'poor judgement/operation', 'failure in communication/coordination', and ineffective/inappropriate use of technology were identified more frequently. In the light of the ISM code and the implementation of safety management systems on-board it is perhaps unsurprising to find many accidents being identified as involving 'inadequate risk management'. What may be a greater surprise to the non-maritime world, in the light of high-profile cases such as the 2012 incident involving the *Union Moon*<sup>3</sup> (where a Polish Master on-board *Union Moon* was found to be under the influence of alcohol), is the very small number of cases which featured alcohol or substance abuse as explanatory factors in relation to accidents at sea.

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<sup>3</sup> This incident is not included in the numeric analysis presented herein as it was only reported in 2012 i.e. after the cut off date of 2011.

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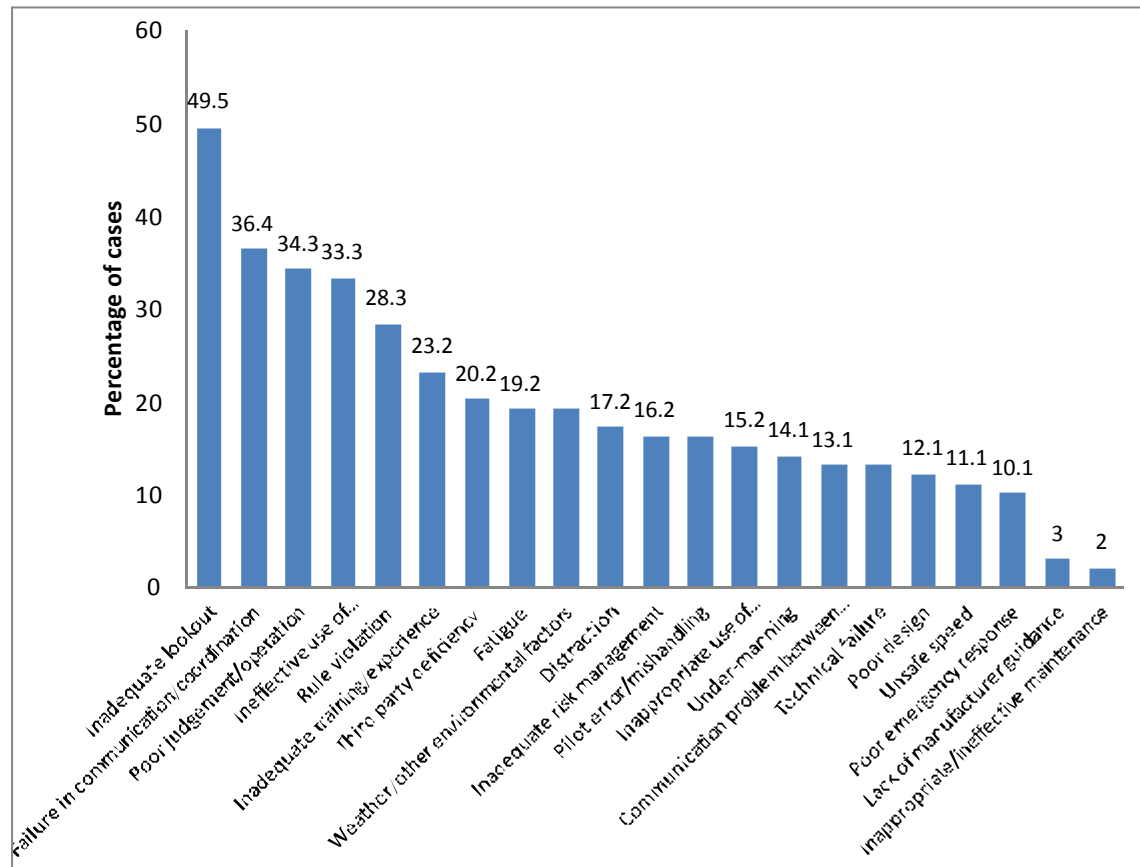
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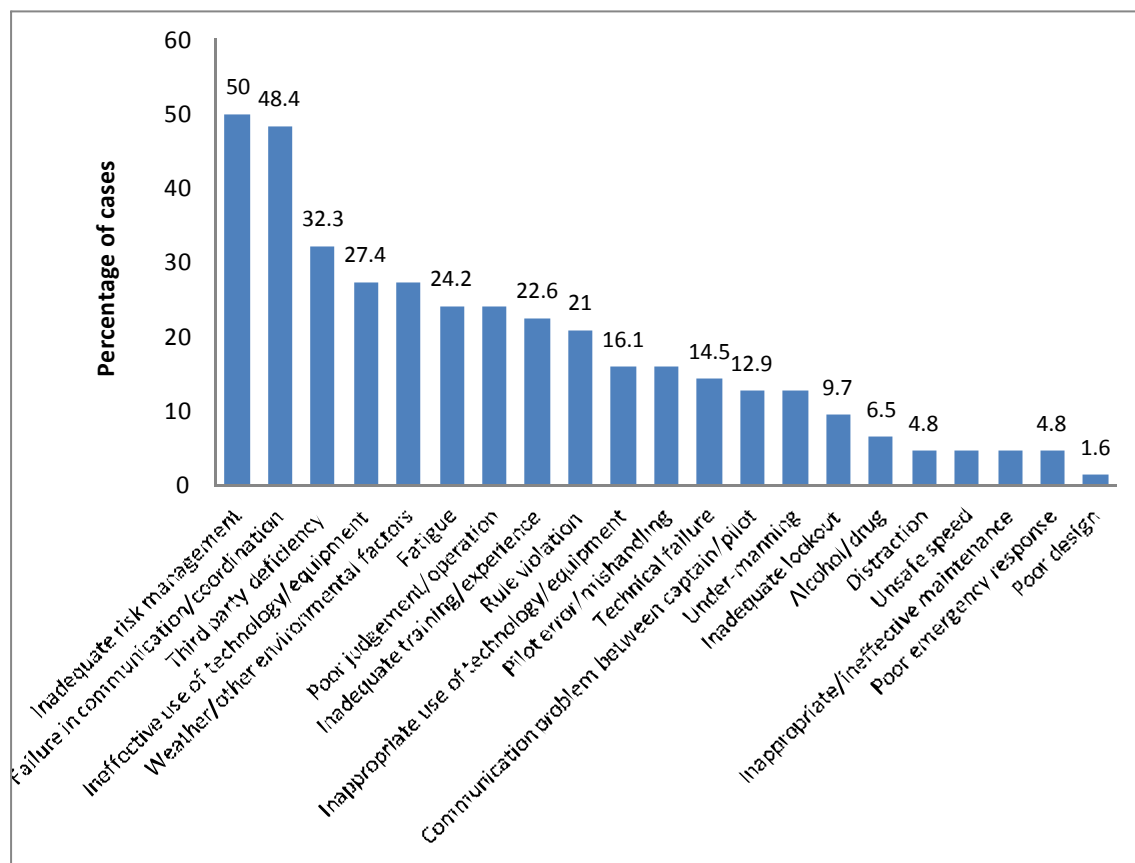
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## Appendix: combined causes of each type of accidents

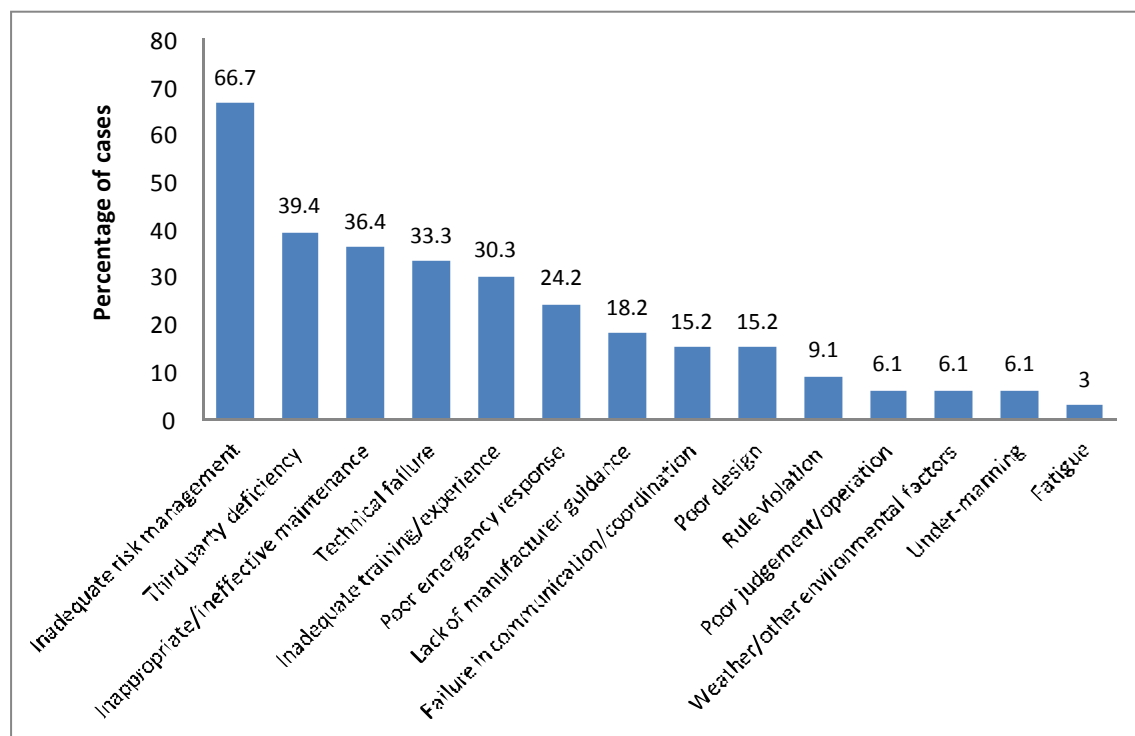
Collision, close quarter & contact



## Grounding

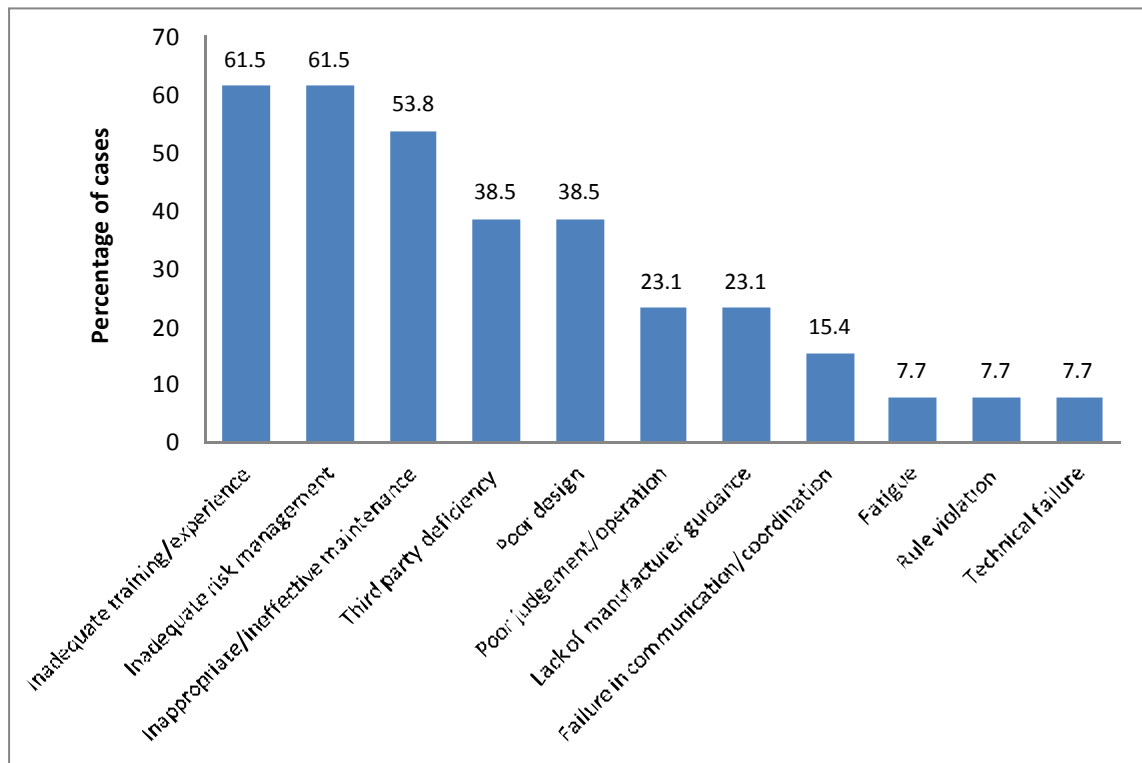


## Fire and explosion

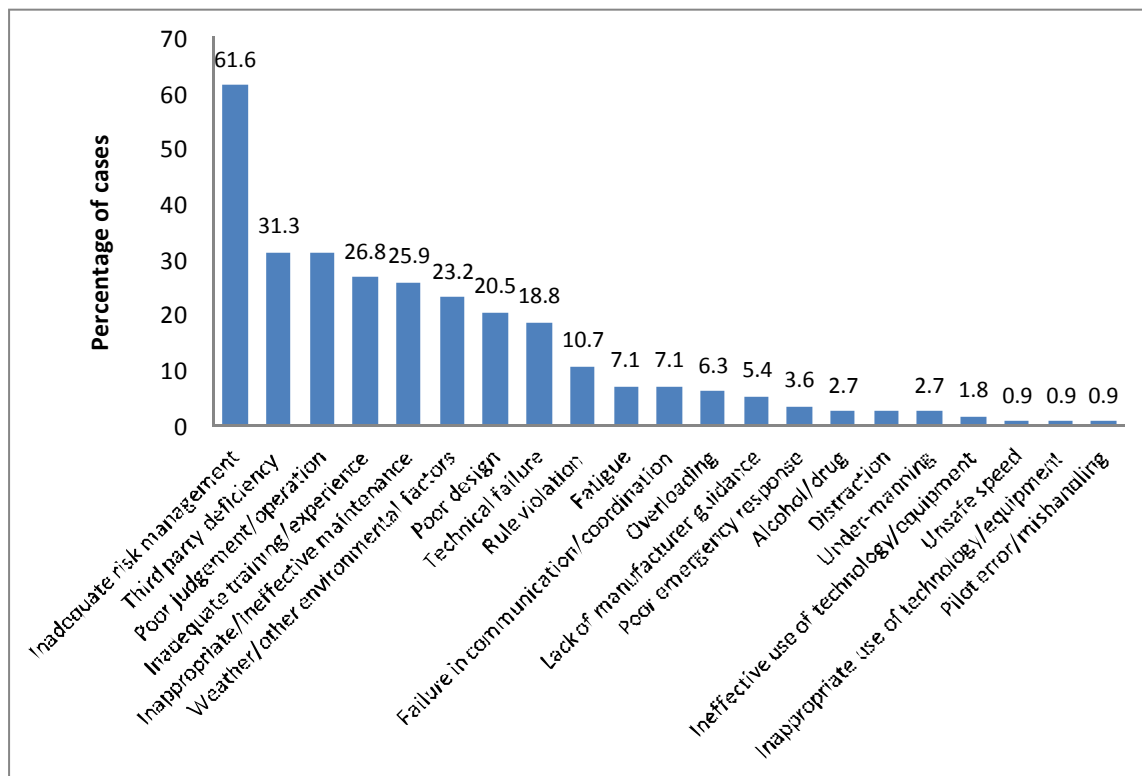




## Lifeboat



## Other



# **‘Walking the Talk’: How Companies Succeed in Managing Risk at Sea**

*Helen Sampson, Nick Bailey & Neil Ellis*

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## **Abstract**

This paper draws upon research about risk and risk management conducted with the support of The Lloyd’s Register Educational Trust<sup>1</sup>. The wider research was large in scale comprising the analysis of over 2,300 questionnaires and a range of data relating to maritime incidents. In addition the study incorporated a detailed analysis of five case study companies. It is this latter element of the research which forms the basis for this paper which considers the differences in perceptions between shore-based, and ship-based, staff working for ship operators in relation to risk management.

The paper explores the means of communication utilised for the transmission of data and ideas about safety and risk management both to, and from, management. It then goes on to consider why it is that despite considerable efforts to write and to talk about safety and risk management, many companies are unsuccessful in encouraging their sea-staff to believe that safety is a genuine company priority and therefore to adhere closely to company policy in relation to safety management.

## **Background**

This paper reports on research carried out as part of a programme of work conducted under the auspices of The Lloyd’s Register Educational Trust Research Unit at the Seafarers International Research Centre (SIRC) on perceptions of risk in the maritime sector. Earlier work has established that there are significant differences between the perceptions of risk held by managers<sup>2</sup> and those of lower ranks on-board vessels. These and other variations in risk perception have been outlined in prior publications by this team of authors (see Bailey et al 2006, Bailey et al 2007, Bailey et al 2010). On this occasion we consider the differences in risk perception across organisations in further detail to try to produce a more nuanced understanding of how the intentions of senior management to communicate particular messages about risk, and risk management, across their organisations may become diluted and distorted as a result of other concurrent actions and inactions.

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<sup>1</sup> On March 2013 The Lloyd’s Register Educational Trust was assimilated into the Lloyd’s Register Foundation. For further information please visit their website [www.lrfoundation.org.uk](http://www.lrfoundation.org.uk).

<sup>2</sup> In comparing the perceptions of different staff across organisations with the reported data on ship level incidents and personal injuries (largely gathered from maritime administrations) we found that the perceptions of senior managers were most closely aligned with the reported incident frequencies.

## Method

The paper draws upon data collected in five organisations using a case study approach that incorporated interviews with shore-side personnel and interviews and observation on-board company vessels. The case studies focussed on two large companies and three medium/small companies engaged in different maritime trades (two tanker, two container, one bulk). Interviews were conducted with personnel at all levels of the organisations ranging from company Vice President in some cases, to Ordinary Seaman (OS). As is our normal practice, the material collected in the course of the study has been anonymised to protect participant confidentiality and thus pseudonyms are used for companies throughout the text.

The two largest case study companies were '*Boxline*' (primarily containers) and '*Vizla*' (primarily carrying oil and oil products). We also included two medium/small companies (*Roberts* and *Wyvern*). *Roberts* was a privately owned company which specialised in the operation of smaller coastal tankers while *Wyvern* operated small container and specialist cargo vessels. Our final case study company was a small part of a larger land-based organisation. The small shipping side of this larger company specialised in operating vessels associated with aggregates. We gave this company the pseudonym of '*Hardacre*'.

### The management of safety

The case study companies varied in their approach to public declarations of safety and the approach they took in delivering safety messages to their employees. *Boxline* and *Vizla*, the largest companies, had very clearly announced and publicised corporate messages about safety which they attempted to convey to both the outside world (crucially their customers) and their employees. Thus managers at *Boxline* referenced what they termed the 'paramount clause' which they described as a clause determining that 'safety comes first', and at *Vizla* similarly unambiguous messages about safety appeared in company literature and at briefings and seminars. *Vizla* also insured that safety occupied a large part of each Board Meeting agenda and it appeared as the first item of the agenda for daily management meetings ashore. These steps ensured that that safety was embedded in company formalities in a transparent manner which was intended to openly convey company priorities.

In both of these larger companies there were dedicated teams of staff dealing with occupational health and safety as at least one of two priorities (the other being environmental

protection). Both companies also had incident reporting schemes in operation and these supported efforts to convey information to their sea-staff relating to new hazards and hazards encountered elsewhere across the fleet. In both case studies there were sophisticated safety management systems in place supported by considerable documentation.

The three smaller companies had smaller management teams ashore and as a result they did not operate with dedicated health and safety sections although *Roberts* did have a nominated Fleet Safety Officer who reported to a monthly Fleet-Safety Sub-Committee. In addition three-monthly company safety meetings were convened at *Roberts* that were attended by the personnel manager, the fleet safety officer, the technical department, the company secretary and the Managing Director. At *Wyvern* and *Hardacre* the Designated Person Ashore (at *Hardacre* described as ‘the only nautical person here’) reported on safety to the company Board – annually in the case of *Hardacre*, and quarterly at *Wyvern*. At *Wyvern* the DPA suggested that he also had the option of walking ‘into the chairman’s office at any time and deal with things on that level’.

In line with international regulations all three smaller companies (*Roberts*, *Wyvern* and *Hardacre*) operated safety management systems, and these incorporated a requirement for safety committee meetings to be held on-board and the reporting/recording of all injuries and fatalities. All three companies supported efforts to reduce injuries and ship level incidents by circulating information to sea-staff about incidents occurring across the fleet.

### **Communicating about safety**

Case study companies chose to communicate the corporate safety message in a variety of ways. On boarding a tanker the first safety message to be broadcast to a seafarer or client might be painted in large letters on a prominent part of the ship. It would probably read ‘no smoking’. Similarly a seafarer controlling access to a vessel might verbally communicate one company safety message by asking if a visitor was carrying any matches. The visitor might then be instructed that smoking was only permitted inside the accommodation spaces. In a similar vein, inside the vessels companies chose to display posters about safety hazards aimed at changing seafarer behaviour. However, although some of these could be ‘hard hitting’ they were not regarded by seafarers as carrying a particularly strong message because of the number of them that they were exposed to and because daily exposure tended to make posters

blend in with the scenery, eventually passing un-noticed by their target audience. Thus one seafarer explained:

You're inundated with posters and stuff like that, and quite often people just switch off to it all you know. (Chief Engineer, *Hardacre*)

Drills also provided an opportunity for safety practices to be inculcated into seafarers but these were sometimes missed opportunities as increasingly sea-staff reported combining several drills into one and implied that the requirement to 'tick drills off' served to undermine the seriousness with which they were treated given the time and commercial pressures under which vessels were operating.

Perhaps the greatest opportunity to communicate from shore to ship and from ship to shore about safety was provided by the monthly safety committee meetings held on-board all of the vessels included in the research. Bulletins and briefings were often sent by shore-side management to the fleet sea-staff to be communicated and discussed at the next safety committee meeting. Sometimes such information was also sent to seafarers individually by email. Such briefings and newsletters tended to focus on fleet-wide trends in terms of health and safety events and would often include examples of incidents that had recently occurred aboard a company ship. They would focus on the lessons to be learned from such incidents and how they could be avoided in future. Seafarers tended to appreciate this kind of information and when it was discussed in safety committee meetings it exemplified successful dissemination of 'top down' messages from shore-side management to operational staff on-board. However, safety committee meetings were less effective than they could have been in relation to improving safety on-board vessels for two different reasons.

Firstly safety committee meetings depend on the participation of employees, in this case seafarers, in order to function fully (Walters and Nichols, 2007, Bhattacharya 2009). The contribution and participation of seafarers is vital if safety committee meetings are to impact on safety on-board in any meaningful way. Seafarers need to be prepared to raise safety concerns at meetings and the more junior seafarers on-board need to feel confident that they can raise issues with senior officers without prejudice. In three of the case study companies such participation was noted by seafarers to be lacking. Fear prevented many seafarers from speaking up at safety committee meetings. In general seafarers were fearful of a poor appraisal by senior officers, of creating 'trouble' on-board, and of losing jobs. In this context

they chose to keep quiet at meetings rather than to risk their future careers at sea. As one AB explained:

They are officers, I cannot stop them what they do ... I never make complaint... I feel if I make a point maybe they make a report ... they can reverse everything... I want to work sea for my family. (AB, *Boxline*)

In this respect closed appraisal systems which do not provide seafarers with a 'right to reply' are not particularly helpful. They are evidently effective in maintaining discipline on-board given that seafarers on temporary contracts set great store by getting a decent appraisal so that they will be employed again. In this context seafarers are respectful to their supervisors and are quick to follow instructions resulting in superficially harmonious relations on-board. However, the other side of this coin is that seafarers are afraid to raise safety concerns or to challenge unsafe behaviour on-board. In this context preventable incidents are highly likely to occur no matter how hard a company attempts to 'educate' its seafarers about hazards or about contributing to safety management on-board. In such cases, a company's own human resource management practices serve to undermine its efforts in promoting safe operations.

Fear of racism also served to undermine the confidence of seafarers in terms of taking part in safety committee meetings. On one ship, junior ranking seafarers explained that unmasking unsafe practice at a safety committee meeting might not be appreciated by supervisors who might feel that they had been demonstrated to be at fault. If any arising resentment resulted in the subsequent poor treatment of the seafarers who had raised concerns, seafarers feared that they would receive no support from Captains and Chief Engineers because they were of different nationality to them and because Captains and Chief Engineers were of the same nationality as the supervisors. Ratings suggested that white officers would band together and protect 'their own' in the event of disputes between whites and non-whites on-board. Thus one rating suggested that in such circumstances he believed that:

The captain would not listen to us because they are the white colour you know. (AB, *Boxline*)

Finally, companies that did not act on ship-shore communication about safety concerns in an appropriate manner conveyed powerful messages to their sea-staff about their 'real' commitment to safety. Where shore-side managers failed to respond to seafarer concerns they were quickly understood to be 'not really' concerned with safety and their safety rhetoric was rapidly dismissed by sea-staff who put simply saw actions as speaking rather more loudly

than words. At *Vizla* for example a huge effort was put into communicating a safe operations message to sea-staff and to the ‘world’. There was also said to be an elaborate procedure ashore for managing the safety concerns which emerged from safety committee meetings. However, when the management at *Vizla* ignored requests that had emerged from safety committee meetings for helmets and radios for smoke divers, and similarly ignored suggestions for engineers to be involved in mooring operations, as mooring teams were short-handed, this was understood by seafarers to reveal where they ‘really’ stood on safety. Seafarers considered that a lack of genuine commitment to safety was exposed by such high-handedness and they also felt that it rendered the safety committee meetings, and their input into them, fairly meaningless.

At *Wyvern* seafarers also believed that the company response to matters brought up at safety committee meetings indicated that the company was more concerned about cost than safety. They cited a situation which clearly held considerable symbolic power for them. In this case a crack had been found by seafarers in the deck of a vessel. The matter had been raised at a safety committee meeting on-board and this had then been referred to shore-side management. However, no action had been taken until such time as the crack had expanded considerably, becoming readily visible, following heavy weather. Such decisions to try to put off necessary repairs and maintenance undermined the confidence of seafarers in company commitment to safety and in the safety committee process.

Conversely, in the one case study company where seafarers did believe that the company was genuinely committed to safety it seemed the company response to communication from the ship to the shore side management following safety committee meetings contributed to this positive perception. Seafarers reported that shore-side management at *Roberts* provided a rapid and effective response to matters arising from the safety committee. As one chief engineer described:

I’ve never seen anything that’s brought up genuinely that the company have not responded to, [*Roberts*] as a company, I couldn’t name you an instance of that, any things that have come up they’ve addressed them and done something about it. You know in a fairly smart manner. (Chief Engineer, *Roberts*)

Thus a poor response from the shore-side management team to matters raised on-board through the safety meetings could serve to seriously undermine seafarers’ perceptions of the company commitment to safety leading to a belief that safety rhetoric and paper-based safety

management systems were just there for show and to ‘cover their (i.e. management’s) backs’. More positively, however, a rapid and effective response to safety matters brought up in the course of on-board safety committee meetings could support both the effective operation of the safety committee which was consequently seen as useful and worthwhile and the perception that the company really meant what it said about safety and about risk management. Such perceptions led seafarers to be more confident about following the procedures laid down in safety management systems and strengthened their confidence in resisting pressures (commercial or otherwise) to be involved in unsafe operations.

### **Getting the company message?**

Fatigue and bad weather were the two factors routinely described by seafarers as increasing levels of risk on-board. In exploring fatigue, we were able to shed light on the extent to which the safety messages promulgated by companies were implemented in the daily operation of vessels.

Of the five companies it was the privately owned company, *Roberts*, which was the most successful in convincing seafarers that it meant what it said, and what it put on paper, in relation to safety more generally and to fatigue specifically. This was in some ways paradoxical as *Roberts* was one of two case study companies operating with small crews and consequently making use of six-on, six-off, navigational watchkeeping systems. Such watchkeeping systems are generally regarded as less safe than systems making use of three watchkeepers, each serving on duty as officer on the watch for two four-hour stretches in each twenty-four hour period. Six-on six-off watchkeeping patterns have been seen to have contributed to ‘accidents’ at sea (see for example the cases of the *MV Lerrix* MAIB 2006 and the *Jambo* MAIB 2003) and seafarers were also clear that under this system it was impossible to get six hours of rest in an ‘off’ period as a result of other demands and disruptions such as meal requirements, drills and alarms. To some extent, fatigue was a taken for granted part of the job, as a result, but in *Roberts* it was evident that not only did seafarers believe that the company meant it when they instructed Captains to go to anchor rather than to sail with an exhausted crew but they also felt confident enough of this to act on the instruction on a fairly regular basis. A shore-based manager explained that:



The hours of work regulations are obviously statutory and they are managed by the master on-board and it is in our quality system, it states that if people are going to be working excessive hours then he is within his rights to stop the ship, drop the anchor and allow everybody to catch up on their sleep until he's happy that everyone is well rested and able to go on with their duties, and this does happen, it's a busy industry and the master is fully supported, he phones up and says 'look you know we've been tank cleaning all night and we're due in port tomorrow but we need a rest'. 'Yes that's not a problem'. (Manager, *Roberts*)

Crucially his account was supported by accounts from serving seafarers. When asked about stopping his vessel to allow seafarers to rest one Captain, for example, told us that:

No, [I have] no problem at all, I call them up, before stopping and I tell them and they say 'yeah no problem'. No pressure at all. (Captain 1, *Roberts*)

This contrasted markedly with the attitude at *Wyvern* which operated the same shift system. Here we were told:

[...] now the company will say "Captain, if your crew are fatigued, stop the ship." But they're only saying that, they don't really mean it." (Captain, *Wyvern*)

In general *Vizla*, and *Boxline*, could be seen as at least partially successful in getting the safety message developed at Board level across to seafarers on-board their vessels. However, despite the extensive efforts made by the larger companies *Vizla* and *Boxline* it became evident that seafarers did not entirely 'buy into' the company rhetoric about safety. In both cases seafarers believed that the companies were more committed to the appearance of safe conduct than to the prioritisation of safety per se.

Fatigue was identified by seafarers at *Vizla* as a major safety-related concern that was brushed under the carpet by shore-side management despite the fact that seafarers frequently attempted to raise the issue at company seminars and similar events. This clearly served to undermine the efforts made by *Vizla* to communicate the overall prioritisation of safety. At *Vizla* the company attitude to fatigue, as expressed by the Vice President, was that fatigue was a matter for personal leadership and management on-board. The implication of this approach was that any fatigue was a result of failings in on-board leadership and management. This immediately conveyed a notion that the subjects of increasing crewing levels, and the disruption of schedules as a consequence of vessels going to anchor to allow watchkeepers to catch up on sleep prior to sailing, were not up for discussion. In our discussions with seafarers it was readily apparent that they had received this message 'loud

and clear'. Seafarers held the belief that for a variety of operational reasons, and given current crewing levels, it was not always possible to adequately manage work and rest hours on-board, something which shore-staff also acknowledged. However, they considered that delaying the departure of a vessel in order to comply with work/rest hour regulations would result in dismissal from the company. In particular one incident was identified by staff in the company as supporting this belief. In the accounts of sea-staff, one Captain was known to have delayed bunkering his vessel for eight hours prior to a loaded voyage because his crew were exhausted. The Captain signed off at the next port and was never seen in the company again. He was widely understood to have been dismissed for his actions and seafarers believed that any similar actions by other captains would almost certainly mean that 'you might as well book your ticket home'.

This general approach by shore-side staff of passing responsibility for the management of sometimes irreconcilable operational and regulatory challenges to sea-staff, and abrogating responsibility for them ashore, served to significantly undermine seafarer belief in the safety message proclaimed by companies. At *Boxline*, sea-staff were less concerned about instant dismissal over fatigue than sea-staff at *Vizla*, but here too when fatigue issues emerged the company criticised sea-staff and their management of fatigue on-board when shore-side decisions for scheduling and crewing were certainly implicated in the problems encountered. Thus we were told of cases where delays resulted from substantial engineering work in port which caused senior engineers to be fatigued. In these kinds of instances, when vessels had proceeded to anchor to alleviate fatigue and comply with rest hour regulations, the engineers had been criticised by managers ashore for failing to appropriately delegate work, the implication being that they could, and should, have managed the work without requiring any delays to the vessel schedules.

It was not only in relation to fatigue that companies were serving to undermine the safety messages they worked so hard to put across. A number of operational decisions were offered as examples of practice that seafarers identified as showing the 'true colours' of management and demonstrating that cost savings were more important to the company than safety.

Seafarers at *Boxline* described several incidents where they believed that safety had been compromised by the company in order to save money. These incidents had sent a very strong message to seafarers across the fleet that ultimately the company was more concerned about the financial 'bottom line' than about safety, despite all the documentation and all the

procedures designed to indicate otherwise. One incident recounted to us at *Boxline* related to a decision made by shore-side managers to allow the watertight integrity of an engine room to be compromised in order to save time preparing for required repair work at the next port. The Captain of the vessel concerned had reservations about this proposal believing that it rendered his vessel temporarily less safe and he reported his concerns to the company. The company response made him aware that not only was his intervention to be overlooked on this occasion but that it was regarded as unwelcome which sent him a very strong signal with regard to the company attitude towards seafarer participation in operational safety. The Captain described how:

I expressed my concerns to it as I thought was my duty of care for the people on-board to report this to the office, and I was told I was being obstructive, rather than just getting something back saying your concerns have been noted. (Captain 1, *Boxline*)

At *Vizla* it appeared that the company did not fall into this trap to the same extent and took great care in communications with senior sea-staff to explain decisions and decision making when such instances occurred<sup>3</sup>. In this sense it had greater success in engaging seafarers in safety management, something that has long-since been identified as central to effective safety management ashore (Walters and Nichols 2007). However at *Wyvern* and *Hardacre* we also found that seafarers had become cynical about the company commitment to safety as a result of a variety of operational decisions. At *Hardacre* the company message that safety should not be compromised for profit was not entirely believed by seafarers as a result of a variety of recent cost-cutting measures which had been implemented and which were understood to undermine safety. Chief amongst these were decisions relating to crewing. A company decision to replace existing crew members with seafarers from Eastern Europe, who were regarded by colleagues as having poor English language skills, was seen to illustrate that the company was not genuinely committed to safety. As one seafarer put it:

Having [East Europeans] on the ship is cost effective. It saves money and they're not bothered whether they can speak English....and the next meeting they tell you how concerned they are about safety. You think, 'they're just lying, all they're bothered about is money'. (Seafarer *Hardacre*)

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<sup>3</sup> NB it was less successful at explaining decisions about matters brought up at safety committee meetings as previously outlined.

In a similar vein, a company decision to move from the employment of two second engineers on-board their vessels to a pattern where a single second engineer would be supported by a third engineer to save cost, was also understood to undermine safety. Moreover a number of seemingly trivial opportunities taken by the company to save money (such as refusing to pay for refreshments when seafarers travelled to join or return from a ship) served to demonstrate to seafarers what they believed to be the company's real attitude towards them and their safety and welfare.

## **Conclusions**

In the course of this research a number of key findings emerged. Firstly companies generally appeared to be placing considerable emphasis on the transparent and public conveyance of safety messages. However, it emerged in the course of the case studies that seafarers and shore-side staff readily distinguish between what they regard as 'real' statements of intent with regard to safety and what they regard as empty rhetoric aimed at charterers, clients, and inspectors. In the small family run company included in the case studies there were less personnel devoted to safety management ashore and there was less glossy publicity about safety than was found at the much larger companies - *Vizla* and *Boxline*. However, it was nevertheless at *Roberts* that seafarers most consistently held the view that the company's safety commitment was genuine and could be trusted. Thus the effort and resource put into the promulgation of safety messages did not straightforwardly translate into a belief in company rhetoric on the part of employees.

In the main, top down messages about safety in the form of bulletins and memos relating to real incidents that had occurred in the fleet were appreciated and were influential as far as sea-staff were concerned. Posters and drills appeared to be less effective in relation to their impact on behaviour. Safety committee meetings, which were found to carry considerable potential for influencing safety management, were found to vary in terms of their effectiveness. In terms of safety committee meetings a variety of human resource practices were found to have the potential to negatively impact on participation in safety committee meetings. Chief amongst these was the practice of hiring staff on 'per voyage' fixed term contracts. Such contracts led seafarers to feel very vulnerable in terms of their future careers at sea undermining their capacity to actively participate in safety meetings or to challenge unsafe practices. Closed appraisal systems and, in one case, multinational crewing practices

involving 'white' senior officer and 'non-white' subordinates further contributed to seafarer vulnerability and reinforced their fears about participating in risk management on-board. Safety committee meetings could also be hugely undermined by inadequate shore-side responses to requests for support for safe practice on-board. Such poor response led seafarers to perceive safety committees as a waste of their time and also reinforced their perception of companies as being unconcerned about real safety issues and only concerned to 'be seen' to be bothered about safety.

One of the most compelling findings from the case studies relates to the extent to which seafarers respond to the perceived commitment of their companies to safety and to regulatory compliance more generally. Where seafarers felt a company held a genuine commitment to safety, as in the case of *Roberts* this impacted upon their own readiness to take radical action should safety appear to demand this (such as anchoring a vessel to allow for rest or in bad weather). Where companies were not perceived to be entirely genuine in their safety rhetoric seafarers were far more fearful of such radical action and frequently felt that it could result in their dismissal. In this, the power of stories passed from seafarer to seafarer about things that had happened to personnel in the fleet who had taken actions of this kind were persuasive. Seafarers were also strongly influenced by their company's response to issues relating to safety when these were raised on-board. Where companies were slow to react to these issues or where they made decisions to circumvent safety in favour of cost-savings, seafarers took such actions to be powerful indicators of the company's true position vis a vis safety. Similarly, seafarers appeared to be influenced by their company's more general attitude to their welfare, and where they found this wanting they also failed to believe that the company was genuinely committed to safety and the principles of its own safety management system. Thus seafarers' understanding of the corporate stance vis a vis safety was found to be very holistic. As a result, companies could potentially spend a considerable amount of effort, time, and perhaps money, attempting to consciously convey one message about safety whilst concurrently, and inadvertently, undermining it on a daily basis as a result of the actions and policies of particular personnel and corporate divisions (for example middle managers and human resource managers). There is some indication therefore that where companies feel that seafarers are not 'getting the message' about safety they would be best served by starting with a consideration of the ways in which their shore-side management and operational decision making may be undermining safety rhetoric, before turning further attention to what more can be done at sea.

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# **Understanding the Relationships Between Ship and Shore Personnel - A New Study<sup>1</sup>**

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## **Abstract**

The working environment of a ship is unusual as a vessel is, in addition, the temporary place of residence for the seafarers who work on-board. The environment is also unusual because of the length of time that vessels spend ‘deep-sea’ far from land and in relative isolation. This solitude combined with the dangers which can be faced at sea tends to produce a feeling of separation amongst seafarers. They feel they are regarded differently by many ‘landlubbers’ who have little idea of what life at sea is like and who they, in turn, may find it hard to relate to. In this context the relationships between shipboard and shore-side personnel may exemplify unusual dynamics. Certainly such relationships are substantially spatially and temporally constrained and this may impact in negative ways upon essential operational matters. This paper relates to a new study of the interaction of ship-based and shore-based personnel. Drawing on shipboard observations and interviews, the study will explore the relationships between active seafarers and shore-side staff such as pilots, surveyors, inspectors, service engineers and vessel agents. In this paper we outline some of the factors identified in the wider literature that may potentially influence such interaction on-board.

## **Introduction**

In a study of maritime accident reports (2002-12) produced by the Maritime Accident Investigation Board (UK), the Australian Transport Safety Board (Australia), the Maritime New Zealand (New Zealand) and the National Transportation Safety Board (USA), Tang et al (2013) highlight the crucial role of communication and interaction on-board in the occurrence of accidents at sea. Their findings indicate that ‘failure in communication’ constituted the fourth highest immediate cause of accidents as identified by accident investigators in the four maritime administrations in the period 2002-12. Failures in communication also constituted the second highest contributory cause identified in relation to these accidents.

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<sup>1</sup> Please refer to Appendix 1 for interpretation of shore-based personnel.

These findings though not solely focussed on interaction between shipboard and shore-based personnel highlight the impact of interaction on operational matters which in turn bears upon safety issues on-board. This paper focuses on issues identified in the existing literature that impact upon interaction between shipboard and shore-side personnel. However, it should be noted from the outset that, although concerns have previously been raised by maritime industry leaders (see, for example, Maritime Directorate 1991 as cited in Sampson and Zhao, 2003) about the crucial role of interaction on-board, to date there has been little specific research undertaken in this area.

A review of the field reveals that studies of interaction between shipboard and shore-side personnel are largely notable by their absence. The material that is available generally takes the form of personal accounts in maritime publications and magazines by either shipboard or shore-side personnel who relate their experiences of interacting with each other.

The small number of relevant studies reported in scholarly journals concern on-board interaction which is limited to interaction between passengers on cruise ships, interaction between seafarers and shore-side management staff in the same companies and interaction between seafarers themselves. For example, a study by Bailey et al (2006) focuses upon the interaction of seafarers engaged in navigation on the bridge of a merchant ship; a study by Papathanassis (2012) is centred on the guest-to-guest interaction on-board cruise ships; and research presented by Sampson (2003) considers the role of power relations and interaction between masters and subordinate seafarers in accidents and incidents at sea. Finally Xue (2012) discusses communication between Chinese seafarers and ship managers and the role of such communication in influencing shipboard occupational health and safety management (see also Sampson et al, 2013). It is worth briefly outlining the main findings from these studies before moving on to a broader consideration of the literature which frames this area of interest.

Papathanis (2012) considers social interaction amongst paying guests on-board cruise vessels. According to this research interaction between guests from different social backgrounds, who occupy differently priced rooms/suites on-board, produces the potential for misunderstandings and, as a result, conflicts frequently erupt amongst cruise ship passengers. Here, contrary to the expectation of cruise ship managers, the manipulation of space and the importance given to social interaction as a prime



consideration in the creation of a unique experience on-board, creates more anxieties than enjoyable experiences for guests.

Moving on to seafarers themselves, the focus of a study by Bailey et al (2006) is a talk sequence that occurs on a ship's bridge and how this sheds light on the practicalities of communicating in noisy spacious environments. This is argued to have implications for the simulator training in bridge resource management that seafarers undergo in the course of their life at sea.

Sampson (2003) presents the argument that power relations on-board can have serious repercussions for safe navigation at sea. By looking at the power differentials that exist between masters/officers and lower-ranked seafarers, she underlines the serious potential for accidents in environments where seafarers are too afraid to contest the opinion of masters and/or officers, no matter what the circumstances. In particular, she highlights the problems which may be associated with an 'authoritarian' style of leadership amongst masters.

Finally, two studies have emphasised the importance of communication between ship and shore personnel in relation to safety management. Bailey et al (2012) demonstrate how communication is currently more effective in relation to the communication of 'top down' messages from management to seafarers than it is in relation to the 'bottom up' communication that is so key to the effective management of safety on-board (see also Sampson et al 2013). While in a similar vein Xue's (2012) study shows that the flow of communication between Chinese seafarers and ship management staff is asymmetrical and that ship owners/management tend to dominate and influence communication leaving little room for seafarers to voice concern over issues concerning health and safety.

The studies cited above are helpful in highlighting some of the issues that are likely to emerge in relation to consideration of ship-shore personnel relationships such as: misunderstandings and conflict; the influence of power relations; and the impact of the environment on communication. However, the remit of these studies was limited to the interaction that takes place between and amongst seafarers (Bailey et al, 2006 and Sampson, 2003), or between seafarers and shore-side management staff in the same companies (Bailey et al, 2012, Sampson, 2013, Xue, 2012), or in the case of Papathanassis, interaction amongst guests on-board.

Evidently, there is a gap to be addressed concerning the dynamics of interaction between shipboard and shore-side personnel and how it impacts on operational matters on-board. This paper, therefore aims to outline the background to a new three-year study of interaction between shipboard and shore-side personnel which is jointly funded by the Lloyd's Register Foundation (LRF), The TK Foundation and Cardiff University. The purpose of the paper is to identify emergent issues arising from a diverse range of literature which will inform the future ethnographic work to be conducted as part of the research.

## **Methods**

In undertaking this review we adopted three approaches. In the first instance we undertook reviews of academic literature and what might be termed 'grey' industry-associated literature such as journals, magazines and newspapers. We then followed this with internet searches to access information published on-line. In using the internet as source of information, we undertook a general search using the keywords "social interaction", "social interaction AND seafarers", "bridge team management", and "on-board communication". The same keywords were used in searching for relevant literature published in scholarly/specialised academic journals (via Scopus<sup>2</sup>). Finally, we made use of the available, general social science, literature about 'life and work at sea', scouring this to identify relevant issues hidden amongst the findings which would not have been picked up using keyword searches as such.

## **Emergent Issues**

### *Paperwork and its potential to impact on social interaction on-board*

While 'paperwork' (which may increasingly be computerised administrative work) is part and parcel of many work environments, at sea paperwork and administration may impinge on interaction if, and when, it comes to dominate workload excessively.

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<sup>2</sup> Scopus is a large abstract and citation database of peer-reviewed research literature relating to a variety of disciplines including the social sciences. The database includes details from over 20,500 titles from more than 5,000 international publishers.

In this context it is relevant that several studies have made specific reference to the increased quantity of paperwork on-board. In a paper published in 2003 Sampson and Wu describe the ways in which seafarers regard their jobs as becoming increasingly paper-based and how, in many cases, they resent the ways in which such changes are impacting upon the exercise of ‘seamanship’ on-board. As one seafarer observed:

How I see it with the paperwork, it’s a jungle [...] Too many systems, I can’t oversee it [...] Generally I like to sail [...] Seamanship? This is not Seamanship [rustles papers] this is horseshit! (Sampson and Wu, 2003: 142)

In a later publication based on different fieldwork undertaken on-board a variety of ocean going vessels Sampson further observes that:

Captains and chief engineers have found their jobs to be increasingly dominated by ‘paperwork’ or more accurately bureaucratic tasks. This generally requires them to be seated in their offices (dayrooms) at computer terminals [...] (Sampson, 2013, p. 94).

Knudsen (2009) also documents this rising tide of paperwork and administration on-board vessels and the resistance to these developments found amongst seafarers. She notes that “when it comes to ‘paperwork’ such as filling checklists or reading risk assessments, various objections [by seafarers] are raised” (Knudsen, 2009, p. 297) and goes on to suggest that not only is some paperwork perceived as unnecessarily bureaucratic and time-consuming, sometimes it is even seen as counteracting safety (op cit). An article in the industry journal *Seaways* further confirms the general view that paperwork can be excessive:

“[...] there are a number of stumbling blocks in the process of preparing for port calls, not least the different documentation required by ports – often, even when they need the same information, it will have to be entered into entirely different forms, with formats for pre-arrival information varying from a phone call to providing non-zipped Microsoft file 24 hrs before arrival” (Timmins, 2011, p. 26).

Excessive paperwork adds to the demands already placed on seafarers by the fast turnaround of ships and reduced manning levels. As such, paperwork can contribute to fatigue which may have implications for interaction with shore-side personnel.

In this context, it is not unusual to find examples of seafarers expressing the following view that when ships dock there is a need:

“[...] to fill out a myriad of forms for customs, immigration and quarantine which adds further to seafarers’ workload” (Timmins 2011, p. 28).

It is interesting that in this example the opinion is expressed with specific reference to arrival in port as a considerable amount of ship-shore personnel interaction takes place precisely at this point in a voyage cycle. Thus, this would seem to indicate that it is worthwhile investigating the relationship between paperwork and interaction in further detail.

In taking note of seafarers’ distress over this ‘culture of paperwork’ in the maritime industry, we have to consider the context of their discontent. As one master describes this: “All masters will know these situations: cancelling dates to catch up with the working hours in the next port to adhere to; tides; locks... (Zanen, 1997, p. 27).” It is likely that confronted by such paperwork and a myriad of other concerns, the master’s interaction, and indeed the interaction of other seafarers, with any visiting shore-side personnel may be affected, most especially, as in this example, when the master comes face to face with an:

“ambitious port-state control inspector who goes with his magnifier over a well-found vessel which is under time pressure to leave or the surveyor who is still fiddling with his figures when pilot, tugs and linesmen are waiting, etc. (Zanen, 1997, p. 27)”.

In other sectors, research has highlighted the extent to which the demands of paperwork may conflict with other demands placed on workers who require time for necessary and effective interaction in the course of their jobs. In the health services, for example, there is evidence that nurses and doctors complain that they don’t have sufficient time to properly look after their patients because they are required to complete too much paperwork (see, for example, Carr and Kazanowski, 1994; Moore and Katz, 1996; Payne et al, 2000).

Taken as a whole, this evidence suggests that paperwork is one aspect of the work-role that should be taken into consideration when we consider seafarers’ interaction with shore-side personnel as there do appear to be clear indications within the existing literature that paperwork may have unanticipated consequences for ship-shore interaction as well as for a number of other areas of work.

### *The remoteness of the vessel*

Despite reductions in the overall length of voyages between ports, brought about by increases in achievable vessel speed in the twenty-first century ships are paradoxically more remote from the shore. This is largely because vessels have become more difficult to access. The International Ship and Port Facility Security Code (ISPS code) has meant that ship visitors are more carefully controlled once a vessel is in port and this can be seen to have reinforced the geographic barriers between ship and shore personnel which are produced by: the international character of the industry; the increased automation of many terminals which has resulted in restricted access to quaysides; and the increasingly remote location of many new port terminals and facilities (Sampson and Wu, 2003).

A study of a container terminal, where the shipping line which was served by the terminal and the terminal operators themselves were owned by the same parent company, is illustrative. Here the spatial separation of the vessel from the terminal caused by the organisation of the 'yard' and the restricted access to the yard by all personnel was described as creating a gulf between shipboard and shore-side personnel. Whilst simultaneously regretting the marked lack of interaction between the shore-side staff and sea-staff a manager at the terminal observed at interview that:

The thing is that we are sitting here, and to go down to the ship you have to go around [gestures a long route circumventing the yard]. So it is a distance of [several] kilometres. People don't do it. (Sampson and Wu, 2003:135)

This lack of regular social interaction between sea and shore staff, even when working for related companies, may well serve to increase the extent to which seafarers feel they are different to, as a consequence of being remote from, land-based workers who were historically and symbolically characterised as 'landlubbers' in the UK fleet. This feeling of 'difference' and isolation carries the potential to undermine effective interaction and may well contribute to the tensions that can be experienced between shore and sea-staff in the course of face to face meetings. However, the remoteness of the vessel is also likely to diminish the possibilities of such face to face meetings occurring at all and to reduce interaction to that which is facilitated by email access or telecommunications, both of which may negatively impact on the quality of such interaction. As Lightfoot notes, for example, 'The messages sent by e-mail tend to be more ambiguous and subject to misinterpretation than is commonly realised' (Lightfoot, 2006: 218). This is, therefore, a

second area that needs to be taken into consideration when exploring the interaction between ship and shore-side personnel. Specifically it will be important to consider whether the limited interaction between seafarers and shore-side personnel, in itself, produces a lack of understanding and poor quality interaction. Furthermore the role of non-face to face communication via email and telephone will need to be considered and attention will need to be paid to the limitations and benefits of such interaction.

*Issues of legitimacy: the credentials of shore-side personnel*

As already indicated, work on the ship is qualitatively different from work ashore (see, for example, Baum, 2012 and Sampson, 2013) and there is a prevailing belief amongst many seafarers that some of the shore-side personnel that they deal with, such as pilots for example, should have on-board experience in order to properly understand the shipboard environment.

In this context, evidence to suggest that seafarers might be required to interact with shore-side personnel who are younger than them and who have little (or perhaps no) sea-based work experience, may be of relevance. For instance, a port inspector reports that the current crop of surveyors and inspectors are:

“[...] retiring with no replacements coming through the ranks. This means that many organizations – e. g. classification societies, flag states, port state control – are using fresh graduates from universities as surveyors and ISM auditors who have little or no shipboard experience” (Wall, 2007, p. 5).

It is possible that age differences and a lack of sea-based experience amongst some shore-side personnel may negatively impact on interaction between shipboard personnel and their shore-based colleagues. Research elsewhere has noted the impact of generation on workforce relations. For example, Oshagbemi quoting Mitchell's (2000) study of American workers asserts that “age tends to give greater or lesser degree of expression of individualism among the workers with the younger generations feeling more comfortable exhibiting individualistic behaviours”. Mitchell (2000) further suggests that generations matter because of the resulting differences in attitudes and behaviour between two generations (2008, p. 1897, see also Mellahi and Guermat, 2004). Furthermore, the interactional consequences of working with others of a different generation are explicitly referenced in research considering relatively young managers and older subordinates, Uen et al explain:

Young managers with less time in their current position also show more difficulties getting along with senior subordinates because these senior people may feel uncomfortable accepting instruction from junior management (2009, p. 325)

The impact of age difference may be particularly significant in the hierarchical and culturally differentiated shipboard environment (Sampson, 2013 and Harrison, 1975). As a scenario, for example: a master in his 60s, with some 40 years of sea experience, may be required to interact with a port inspector in his early 20s, who is a fresh graduate and with no sailing experience at all. Here, the age and professional-biographical differences between them might influence their routine interaction as the master remains conscious of his seniority and years of experience, while the inspector exercises his authority on the basis of his position. This is just a hypothetical scenario but anecdotes from seafarers who have dealt with “overbearing” young inspectors in combination with research undertaken in other workplaces indicates that it is worth considering the influence of both age and sea-experience in relation to ship-shore interaction

In relation to pilotage, in particular, there appears to be a prevalent sentiment amongst seafarers that it would be beneficial to bridge resource management if pilots had experience of command prior to joining the pilotage service. Australia and the UK, currently require pilots to be qualified masters. In the case of Australia they are required to have sailed as masters for three years prior to becoming licensed pilots (AMSA, 2013). These requirements are not universal, however, and it is worth considering how pilot qualifications and experience may impact on pilot-master interaction. It may be, for example, that having experience as a master may give a pilot a better understanding of the demands made upon the master and that this could improve interaction between them. As one pilot suggests:

They [pilots] would definitely look in a different way at certain situations in which the master may find himself; and then easily remember their own days as a master (Zanen, 1997, p. 27).

This individual continues that where pilots lack sea-experience “it is important to include items in the pilot’s training that will give him a better insight in today’s shipmaster’s position; so the pilot, who has never been in command will ‘understand’ the master’s position, not only in matters of navigation and shiphandling but also commercial matters” (Zanen, 1997, p. 27)

### *Language barriers*

In the context of a highly internationalised industry, the role of language in ship-shore interaction cannot be overlooked.

Initial meetings, by their very nature, are fraught with uncertainties and people are generally regarded as exerting considerable effort to overcome these uncertainties (Knobloch and Solomon, 2002; Clark et al, 2004; Dockery and Steiner, 1990; Lee and Gudykunst, 2001). As Boucher and Jacobson acknowledge:

Interpreting behaviour during interactions with strangers, or initial interactions, is further complicated by the fact that we possess little information about our partners, increasing our uncertainty (2012, p. 652).

What happens in initial meetings between shipboard and shore-side personnel may be crucial in setting the tone for workable interaction. Communication theorists observe that:

Strangers, upon meeting, go through certain steps in order to reduce uncertainty about each other and decide whether one likes or dislikes the other. [...] strangers enter an interaction with high levels of uncertainty about one another (Feeney, et al, 2009, p 491).

However taking steps to reduce uncertainty may not be possible in the context of ship-shore interaction which may: take place under considerable time pressure; occur in noisy environments that curtail the possibilities for effective communication; and take place between people of different cultures.

There are specific challenges associated with inter-cultural encounters where participants are said to interact not only as individuals but also as perceived representatives of their respective cultures. Each participant brings to the interaction a different native language and a different cultural upbringing that is generally unfamiliar to his or her interactional 'partner'. These in combination with other dissimilarities, including appearance, target language proficiency, and manner of communication, may create a sense of foreignness that can undermine effective interaction (Chen, 2003, p. 184).

Further to this, as Lewis has observed in the area of management studies, "cooperation in the workplace may be affected by cultural predisposition" (2011, p. 964). Compounding these influences is the impact of the transmission of culturally rooted 'signals'. These lead to the potential for individuals faced with a counterpart from another culture to easily



misread a signal or transmit an unintended message (Morris, et al, 1998, p. 729). For example, in their study of conflict management style between American and Asian managers, Morris et al explain:

A different type of misunderstanding occurs when Asian managers make the error of reading a US colleague's direct adversarial arguments as indicating unreasonableness and lack of respect (1998, p. 730).

The extent to which such cultural styles underpin interactional difficulties between ship and shore personnel is under-evidenced at present. However, it is apparent that the use of words is significant to ship personnel in their interaction with shore-side staff, including officials, and this highlights the potential for cultural differences (be these occupational, or national) to undermine co-operative interaction. This is, for example, the point made by a British master whose ship was inspected in a European port when he was told by inspectors that the ship 'was under attack' for its deficiencies. This did not sit well with the master. He found the expression disturbing.

“I also told him, politely, that I thought the use of the words ‘under attack’ was unfortunate. He denied using them and said that was not his approach [...]. He did use those words and everything about the inspection was conducted with that mentality. We were constantly having to defend ourselves against implied accusations of incompetence, indifference and/or deceit, (while trying to remain polite and helpful ourselves) (*Nautilus UK Telegraph* 2007, p. 16).

An ill-chosen word or phrase in an encounter can be much resented on-board vessels where staff already feel under immense pressure and it would seem that such unhappy encounters between ship and shore personnel may be on the increase:

“ [...] the aggressive approach is the attitude we encounter more and more from representatives of most of the authorities who board us around the world [...] (*Nautilus UK Telegraph* 2007, p. 16).

In such instances, when words produce hostility, the offended party may reciprocate with what he/she understands to be the same attitude leading to an escalation of poor relations. For example, interpersonal theory suggests that during social interaction, the behaviour of one person invites complementary behaviour from the other person such that individuals alter the interpersonal styles of their interactional partners (Feeney et al 2009, p. 490).

In addition, it could be said that failure to master the English language (as the international language of the sea) might serve as a barrier to sustained interaction with

shore-side personnel. In general terms, poor communication has been identified in a variety of reports, and accounts, as a feature of the bridge team when a vessel is carrying a pilot. The lack of interaction between masters and pilots has, for example, been mentioned in accident investigation reports. Thus, in the case of *Sea Empress*, “the pilot and the master had not discussed and agreed a pilotage plan and as a consequence neither the master nor the chief officer (whose watch it was) knew what the pilot intentions were (Colson, 1998, p. 24).

In many cases it may not be that language barriers are the primary cause of poor pilot-bridge team interaction. However there are indications that cultural and/or language barriers may be implicated in some instances. In the case of *Cosco Busan*, the voice data recorders captured very limited interaction between the US pilot and the Chinese master despite the fact that the pilot made it clear that he did not understand the vessel ECDIS. The detailed accident investigation report paints a picture of a hostile relationship between the US pilot and the Chinese master which may have been a result of ethnic/cultural differences combined with language barriers and the individual characteristics of the personnel involved. A quote from an interview with the Captain which is reproduced in the accident investigation report is revealing:

And then [this] pilot came on-board with a very cold face. Some of them just don't want to pay attention on us and some of them would not like to talk with us ... It seemed the pilot coming on-board was with cold face, doesn't want to talk. I don't know if he had a hard day before or because he was unhappy because I was a Chinese.

NTSB Marine Accident Report, 7 Nov 2007, pp 67-68

This quote is also helpful in reminding us of the potential for racism and stereotyping to impact on inter-cultural interaction in self-evidently negative ways.

## **Conclusions**

Human interaction is a complex process which cannot be reduced to a mere exchange of words. Furthermore, in the context of a workplace, interaction may be subject to rather particular constraints and challenges. Lewis for example (2011) indicates that:

“...a group of workers brought together to form a work team may or may not coalesce in an optimally desirable way. Aspects of group variability, such as gender, race, seniority, or perceived competence, may hinder smooth functioning. By their very nature, workplaces constitute controlled environments that impose limits on how individuals within them might behave in groups” (2011, p. 966).

In relation to shipboard interaction between sea-staff and shore-staff the literature points to a number of areas where attention could usefully be focussed in the course of future empirical investigation. Thus consideration needs to be given to the context of interaction including the remoteness of ships as workplaces and the implications of this for relationships between ship and shore personnel. Workloads, and the workplace demands placed upon seafarers, and also upon shore-side personnel, will also need to be taken into account in thinking about the context of interaction and the impact of this on the quality of ship-shore relationships. The perceived legitimacy of the interacting parties (which may be affected by factors such as age and experience) may also be relevant and again this may relate equally to the legitimacy attached to sea-staff and to that associated with shore-staff. Further to this it will be worth considering the duration of interactions between personnel. In this attention will be given to the opportunities for personnel to build relationships over a period of time. Finally we will need to pay attention to the cross-national nature of much interaction between shipboard and shore-side staff and the implications of this for clarity and for confusion in communications.

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## Appendix 1

When referring to shore-side personnel, we have in mind the following but a caveat must be made here. In reviewing literature related to the topic, not all these shore-side personnel are covered. In fact, only inspectors, surveyors and pilots will be mentioned due to the non-availability of materials pertaining to other personnel. But it is hoped that the issues faced by these shore-side personnel mirror to a certain extent the concerns of other shore-side personnel in their interaction with shipboard personnel, or vice versa. The shore-side personnel are the following:

1. Pilots
2. Riding Crews (including 3<sup>rd</sup> party contractors)
3. Service/ Maintenance Engineers (for example, software engineers)
4. Shore Side Maintenance Crews
5. Stevedores
6. Surveyors/ Inspectors
  - i. Vetting
  - ii. Flag/port state
  - iii. Classification
  - iv. Insurance
  - v. ITF
  - vi. Customs
  - vii. Police
  - viii. MLC
  - ix. Accident investigators
  - x. Company Superintendants
  - xi. Customs

# **The Use of Mandatory Equipment On-board – A New Study**

*Nelson Turgo, Neil Ellis, Lijun Tang, Helen Sampson, Iris Acejo*

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## **Abstract**

In contrast to the ships of yesteryear, modern merchant vessels are complex structures incorporating a variety of mechanical and electrical systems. The twentieth and twenty-first centuries have seen a steady increase in the regulation of international shipping by national, regional, and global bodies. One aspect of such regulation has been to determine the essential equipment that all vessels should carry on a mandatory basis. Mandatory equipment specified by the SOLAS and MARPOL conventions of the IMO includes for example, fire fighting equipment; lifesaving equipment and environmental protection equipment.

On-board a vessel it is vital that such mandatory equipment is understood and that, when operated, it is used appropriately and maintained correctly. However there is evidence to suggest that in some cases such equipment is either poorly operated and/or poorly maintained resulting in both a threat to life and to the environment. The reasons for this may be complex and in 2012/3 a new study was initiated at SIRC with a view to exploring the complex factors which may underpin the periodic misuse and neglect of such equipment.

This paper introduces the new study and outlines its aims, objectives, and methods. It then considers the issues raised in the relevant literature which creates a starting point for the research.

## **Introduction**

Modern merchant vessels are complex structures which incorporate a variety of mechanical and electrical components and systems. Some of the equipment carried on-board international ocean going vessels is mandatory under international law. Although such mandatory equipment varies in function, generally speaking, the aim of mandatory equipment is to protect life at sea, and/or the marine environment.

Mandatory equipment can be divided into three categories: emergency response equipment, navigational aids/ bridge equipment, and equipment designed to protect the environment. Emergency response equipment includes life-saving apparatus, fire-detecting and fire-fighting equipment, and emergency communications equipment. The

carriage of emergency response equipment is required under SOLAS. The carriage of navigational aids and bridge equipment including RADAR/ARPA, ECDIS, AIS, Compass, etc, is also mandatory under SOLAS. However, the carriage and use of equipment designed to protect the environment is generally covered by the IMO MARPOL convention. Equipment includes items such as oily water separators and ballast water treatment systems. Table 1 summarises examples of the types of equipment in each of these categories<sup>1</sup>. In this paper we will focus on just three pieces of mandatory equipment: lifeboats; watchkeeping alarms (BNWAS); and oily water separators.

*Table 1: Examples of Mandatory Equipment*

|                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Emergency Response Equipment</b>                                                                                                                                                                                                                                                          |
| Fire fighting equipment<br>Hoses ( <i>SOLAS Chapter II-2, Part A, Regulation 4</i> )<br>BA Sets ( <i>SOLAS Chapter II-2, Part A, Regulation 17</i> )<br>Extinguishers ( <i>SOLAS Chapter II-2, Part A, Regulation 6</i> )<br>CO2 Systems ( <i>SOLAS Chapter II-2, Part A, Regulation 5</i> ) |
| Lifesaving equipment<br>Lifeboats ( <i>SOLAS Chapter III, Part B</i> )<br>Life Rafts ( <i>SOLAS Chapter III, Part B</i> )<br>Life Jackets/ Buoys ( <i>SOLAS Chapter III, Part B, Regulation 7</i> )<br>GMDSS ( <i>SOLAS Chapter IV</i> )                                                     |
| Emergency Alarms<br>Fire Alarms ( <i>SOLAS Chapter II-2, Part A, Regulation 12-14</i> )<br>Water Ingress Alarm ( <i>SOLAS Chapter XII, Regulation 12</i> )                                                                                                                                   |
| <b>Navigational Aids/ Bridge equipment</b>                                                                                                                                                                                                                                                   |
| Navigational Aids<br>AIS ( <i>SOLAS Chapter V, Regulation 19</i> )<br>GPS ( <i>SOLAS Chapter V, Regulation 19</i> )<br>ARPA Radar ( <i>SOLAS Chapter V, Regulation 12</i> )<br>ECDIS ( <i>SOLAS Chapter V, Regulation 19</i> )<br>Compass ( <i>SOLAS Chapter V, Regulation 12</i> )          |
| Bridge Equipment<br>VDR ( <i>IMO Resolution A.861 (20)</i> )<br>Bridge Watch Alarm ( <i>IMO Resolution MSC 282(86)</i> )                                                                                                                                                                     |
| <b>Environmental Protection Equipment</b>                                                                                                                                                                                                                                                    |
| Oil Water Separators ( <i>MARPOL Annex I</i> )<br>Ballast Water Treatment ( <i>MARPOL Annex I</i> )                                                                                                                                                                                          |

<sup>1</sup> Please note the list is not extensive, and only provides examples of some of the common types of mandatory equipment.



Shipboard mandatory equipment has been introduced gradually over a period of roughly a century. Notwithstanding the extended period of this introduction, over time some of this mandatory equipment has been recognised as being characterised by recurrent problems. In 2001, for example, the UK Marine Accident Investigation Branch (MAIB) reported that since 1989 it had received reports of seafarers being killed or injured in accidents relating to the launch of lifeboats. These problems have yet to be resolved as the recent, much publicised, case of the accident aboard the cruise vessel *Thomson Majesty* demonstrates. In this case five seafarers were killed in the course of a lifeboat drill and a further three were injured. Similarly, Oily Water Separators which have been mandatory since the 1970's have performed poorly resulting in the discharge of oily wastes into the marine environment sometimes resulting in fines and the prosecution of seafarers and shipping companies (Grey, 2006).

Common problems with such equipment are frequently technical in nature however there may be other issues which impede the proper use of mandatory equipment. These may include poor maintenance, ineffective training, poor design from an ergonomic standpoint, and so on. In a SIRC study of accident investigation reports, for example, in addition to 'poor design' the following factors were found to have been identified by accident investigators (in four countries over a ten year period) as being associated with lifeboat accidents: 'inappropriate/ineffective maintenance'; 'inadequate training/experience'; 'poor judgement/operation'; 'third party deficiencies' (Tang et al, 2013). With such a persistent history of poor performance, in so many cases, it remains unclear why many of these problems endure. This paper provides the background to a new study at SIRC which aims to delve more deeply into the issues underlying the problems associated with the operation of mandatory equipment in order to try to answer some of the longstanding questions that remain about its performance and use.

The new research is being jointly funded by the Lloyd's Register Foundation (LRF), The TK Foundation and Cardiff University. The intention of the research is to produce a detailed and nuanced picture allowing for the possibility that companies can direct their future efforts with regard to documentation of procedures and the provision of training far more effectively. This should help reduce future accidents as well as mitigating seafarer stress.

In this paper, prior to the initiation of fieldwork, we will focus on three pieces of equipment (lifeboats, watchkeeping alarms, and oily water separators) in order to consider some of the 'known factors' which relate to the use of mandatory equipment by reviewing available published materials which are already in the public domain. This may provide us with an early indication of some of the issues that the fieldwork should consider in relation to a broader range of equipment and it will outline the broad context within which the research will be conducted.

## **Methods**

The literature used in this article was identified via a combination of library and internet search. Academic and industry journals and popular magazines were incorporated in the review and, where these were unknown to us, these were identified using Google, Google Scholar, and academic search engines such as Scopus<sup>2</sup>. In undertaking keyword searches the key terms used were 'maritime industry', 'maritime accidents', 'seafarers', and 'mandatory equipment'. Supplementary searches of related topics in academic journals were also undertaken to contextualise the review and relate the issues connected to the use of mandatory equipment to a broader context.

## **Emergency Response Equipment**

Emergency situations on-board ships present seafarers with considerable personal risk as seafarers are generally confined to the vessel and there is frequently nobody else in the vicinity to help them to deal with emergency situations. To cope with emergencies, ships are required to carry their own fire fighting and life saving appliances, fire detectors and alarms (SOLAS Chapter II-2 and Chapter III). It is also mandatory that fire fighting and lifeboat drills are carried out regularly according to emergency drill plans (Chapter III, Regulation 19). These drills not only involve the use of, and practice with, emergency equipment such as fire fighting equipment and lifeboats, but also teamwork. Such

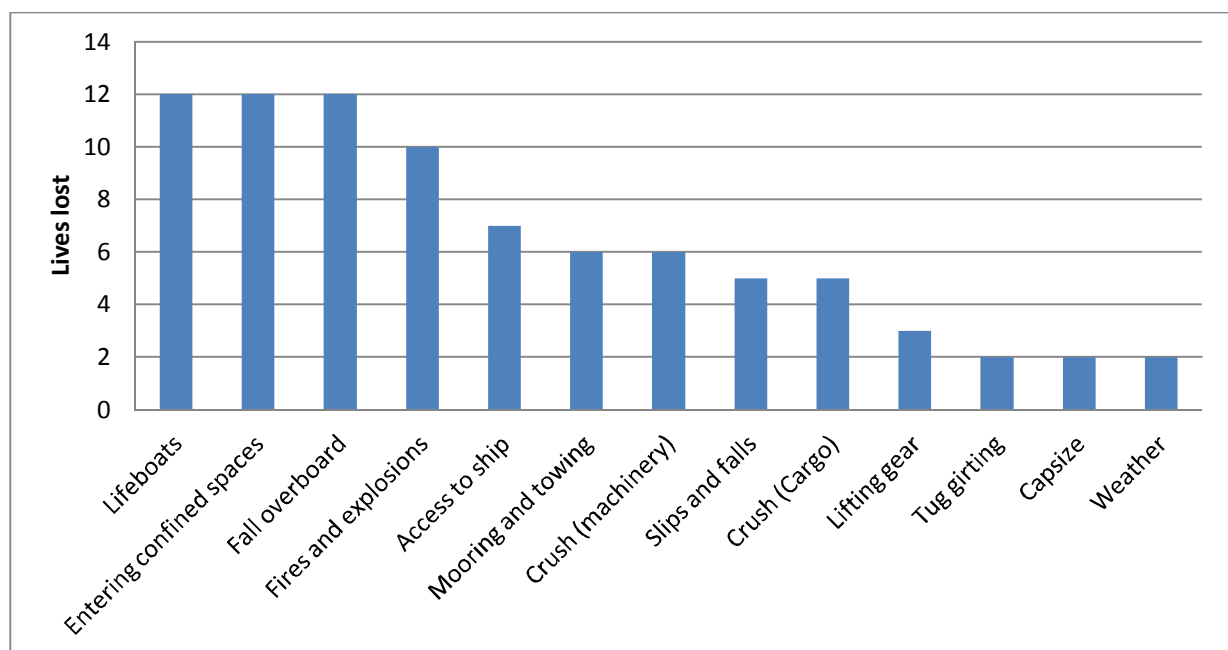
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<sup>2</sup> Scopus is a large abstract and citation database of peer-reviewed research literature relating to a variety of disciplines including the social sciences. The database includes details from over 20,500 titles from more than 5,000 international publishers.

teamwork involves communication and coordination between team members and interaction between people and equipment.

To maximise the effectiveness of drills SOLAS requires that ‘drills shall, as far as practicable, be conducted as if there were an actual emergency’ (Chapter III, Regulation 19: 3.1). This suggests that drills should simulate real emergency situations as closely as possible. One part of this is a requirement that lifeboats should be lowered regularly as part of drills (Chapter III, Regulation 19: 3.3). However, lifeboat drills have come to be recognised as a serious hazard and have resulted in many fatalities (OCIMF, 1994). Indeed some commentators have observed that in some circumstances lifeboats have caused more fatalities than they have saved lives (Barber, 2005). In 2001, the *Review of Lifeboat and Launching Systems’ Accidents* carried out by the MAIB suggested that lifeboat drills were a common source of accidents, and that lifeboat accidents were one of the most frequent causes of fatalities (see Figure 1).

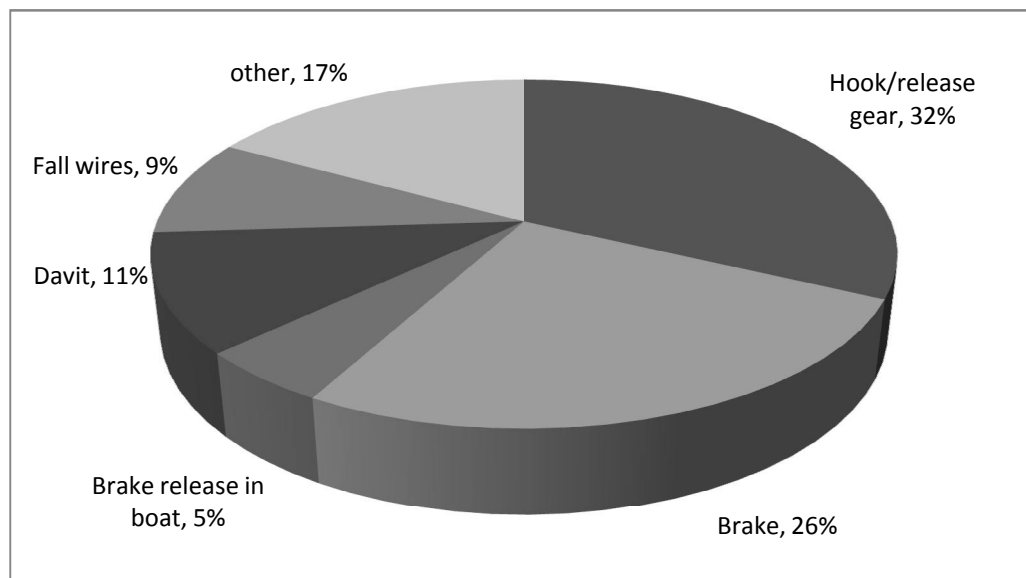
Figure 1: Fatal accidents 1989-1999 (as collected by the MAIB)



The *Lifeboat Incident Survey – 2000* conducted jointly by OCIMF, Intertanko and SIGTTO (2000) further suggested that the majority of accidents (75 out of 89) involved davit-launched totally enclosed lifeboats with on-load release hooks. The on-load release

hook has emerged as a particular problem, as it may open when unanticipated by seafarers and drop a lifeboat into the water from a considerable height. The OCIMF 1994 survey revealed that release system failure and brake failure were two major contributory causes of davit-launched totally enclosed lifeboat accidents (see Figure 2). The subsequent *MCA Research Project 555* (MCA 2006) suggested that while lifeboat accidents also arose from problems associated with other elements of lifeboat launching systems, such as winches, and falls, most serious accidents, especially those leading to fatalities, occurred because of on-load release hook problems.

*Figure 2: Component failure in lifeboat accidents (from OCIMF survey 1994)*



Not only do lifeboat accidents cause injuries and fatalities, but they may also have less obvious effects on seafarers, such as reducing seafarer confidence in their use (MCA, 2006; OMICF, 1994) and undermining the efficacy of drills. Captain Dennis Barber (2006, p. 22), a ship inspector, has noted for example, that ‘masters [on vessels with totally enclosed boats, on-load release gear and remote lowering] will often provide plausible excuses as to why they have not done the exercise, citing restrictions in ports by harbour masters as the most commonly encountered reason.’ It is also reported that some Captains resort to falsifying their records of lifeboat drills due to fear of accidents (Maritime Accident Casebook, 2011). The MAIB (2001: 32) review point out:

“Shipmasters report that to raise their crew’s confidence in the systems, they regularly take an active part in launching a lifeboat. Privately they express a feeling of unease, both at taking part in the operation and the need for them to do so.”

Even where they are carried out it may be that lack of confidence in lifeboat safety serves to undermine the training benefits associated with drills. The available literature on training, and the importance of motivation in effective training, (see for example Noe and Wilk, 1993; Facticeau et al., 1995; Mathieu et al., 1992 4 XLRQH, 1997, Wei-Tao 2006) suggests that it is reasonable to posit that lack of confidence in lifeboat safety, and the fear that this is likely to promote, will undermine the efficacy of lifeboat drills. Webster and Martocchio (1993) have specifically linked anxiety to reduced training motivation (Cloquitt et al, 2000). That such anxiety amongst seafarers remains prevalent in relation to lifeboats seems evident. In 2013 a ‘discussion’ of lifeboat safety was promoted by the industry association *Intermanager*. In a summary of the findings *Intermanager* reported that one seafarer ‘likened his onboard training to ‘Russian Roulette’’ (<http://www.intermanager.org/2013/05/intermanager-discussion-reveals-lifeboat-hook-concerns/>).

There is also a body of evidence which suggests that the degree of commitment from supervisors/managers to training markedly influences worker motivation with regard to training (Gist, 1987). In this context it seems reasonable to assume that where shipmasters and seafarers themselves are uneasy about holding, and taking part in drills, (as reported by the MAIB in 2001 op cit) this is likely to undermine both seafarer motivation and, as a consequence, the usefulness of drills as training scenarios.

These observations may help to explain why training in relation to lifeboat operation has sometimes been identified as flawed. A recent survey, in which 62 accident investigators responded to an on-line questionnaire about the lifeboat accidents they had investigated, found that respondents were likely to see on-board training and maintenance as ‘not fit for purpose’ (Maritime Accident Casebook, 2011). There are also a number of specific accident investigation reports which identify poor training as contributing to, or causing, lifeboat-related accidents (see for example the case of the tanker *Port Arthur* ATSB 2004 and the bulk carrier *Sea Urchin* TSB 2006). It has been observed that unstable crewing practices (crew not regularly returning to the vessels with which they are familiar) and the variety of different lifeboat designs compound training problems and increase the

likelihood that accidents will occur. The Canadian report into the accident involving the lifeboat of the vessel *Sea Urchin* highlights for example that:

The large number of often complex designs, combined with the fact that crew members rarely return to the same vessel, creates a lack of familiarity with an essential piece of lifesaving equipment, thereby continuing to put seafarers at risk. (TSB 2006:13)

As well as design and training problems, there have also been problems associated with poor maintenance and resultant ‘equipment failure’ identified in some reports about lifeboat accidents. An OCIMF (1994) survey collected data on 92 lifeboat incidents by distributing a questionnaire to ship operators and national authorities. It found that ‘equipment failures and design shortcomings were responsible for approximately two thirds of all reported lifeboat incidents’ (p.3). The Lifeboat Incident Survey (2000) conducted jointly by OCIMF, Intertanko and SIGTTO, which collected data on 89 lifeboat incidents, using the same questionnaire, depicted a similar situation. In a later study Ross (2006) analysed 266 lifeboat accident reports gathered from seven countries. He noted that in terms of frequency design, training, and maintenance were almost equally identified as underlying causes of lifeboat accidents. Importantly, Ross observed that accident investigations were always subjective and that in most cases design, training, and maintenance were interrelated, for example, poor design might make maintenance difficult and thus lead to poor maintenance.

The aforementioned *MCA Research Project 555* (MCA, 2006) also considered these issues and sought views from manufacturers, ship owners/managers, seafarer trade unions, and seafarers. Their survey suggested that:

- Though many existing on-load release hooks satisfy legal requirements, they are inherently unstable, unsafe, and not fit for purpose. Some hook designs are sensitive to wear and can become dangerous after repeated disengagement. Further, under SOLAS requirements, lifeboats and launching equipment are primarily designed for one-off use in emergency. They are not designed with a particular view to their being launched and recovered in the course of drills. There is a suggestion that it is technically possible to design safer and more reliable systems, but there is little commercial incentive to go beyond minimum legal requirements.
- Lifeboat safety problems are rarely reported to the manufacturers.

- Work pressure leads to the lack of time for training and drills.
- There is no standardisation in hook designs and manufacturers (for obvious reasons) are unwilling to collaborate with each other. According to one manufacturer, there are around 70 different on-load release systems (LSM 2007). As a result, seafarers may face different designs of hooks on different ships, but may not be aware of different operational procedures and maintenance requirements.
- The marine environment does not allow a maintenance or service free design. Seafarers, however, do not have the knowledge to do adequate maintenance/service. IMO has set out guidelines in MSC Circular 1206 that lifeboats should be serviced by the manufacturer-approved engineers. It has not been adopted into SOLAS, however.

On the issue of maintenance, it is believed that one reason for poor lifeboat maintenance may be that lifeboats are considered to be complex by seafarers, who are particularly wary of the on-load release systems (Gale, 2008). The matter is compounded by the fact that the quality of ‘operation, maintenance and training manuals’ is often poor, as the MAIB (2001: 30) review points out:

“[These manuals] frequently lack clear and accurate descriptions of the equipment and operating principles. Superfluous information, particularly where one instruction manual is intended to serve several types of system, leads to confusion. Inaccurate translations between languages can compound these problems.

These shortcomings result in crews ignoring them on the grounds that they are not only unreliable, but also contain too much extraneous material. They become time consuming to read, and the end result is incorrect maintenance and operation of equipment.”

The consideration of the published literature associated with lifeboats thus raises a number of issues which need to be considered when exploring the use and misuse of a range of mandatory items of equipment. These include the possibilities of design failings, poor training and motivation, poor maintenance regimes, the impact of crewing practices, and the impact of workloads. It is now worth considering the literature published around the use of a rather different piece of equipment (the Bridge Navigational Watch Alarm

System) in order to see if there are other issues which emerge as potentially relevant to the broader study of mandatory equipment.

### **Bridge Navigational Watch Alarm System**

In 2009, IMO Resolution MSC 282(86) was adopted making it mandatory to phase in the Bridge Navigational Watch Alarm System (BNWAS) on cargo and passenger ships between 2011 and 2014. A major factor behind the adoption of this resolution was the large number of groundings and collisions attributed to watch keepers falling asleep. For example, the Nautical Institute suggested that, of human factor related marine accidents between 1996 and 2006, watch keepers falling asleep explained three per cent of collisions and eight per cent of groundings (Gale and Patraiko, 2007). Similarly, the Marine Accident Inquiry Agency (MAIA) in Japan found that watch keepers dozing off caused 28 per cent of groundings around its coasts in 2004 (Gale and Patraiko, 2007).

In order to try to stop watch keepers falling asleep the BNWAS requires the bridge watch keeping officer to periodically (every 3 to 12 minutes depending on the setup) push a button, to prevent an alarm being triggered in the cabins of deck officers and/or of the captain. Other more advanced systems use motion sensors to detect whether the watch keeper is awake, or monitor how bridge navigational equipment is being used to see if seafarers are mentally alert. If these systems detect a lack of motion or a lack of alertness over a certain period of time, the alarm will be triggered. A typical example of a BNWAS panel is shown in Figure 3.



**Figure 3: Example of a BNWAS bridge panel**



Source: <http://gcaptain.com/bnwas-bridge-navigational-watch-alarm/?25555>

As it requires regular attention (generally every ten or so minutes) BNWAS can be irritating, especially as they serve no function in relation to navigational tasks. A short report from Chalmers University of Technology on the use of alarms (and also on the need for display dimmers) on-board modern vessels, highlights the extent to which alarms should ‘alert the officer of the watch to a problem, not be an annoying distraction of little informational value that constantly needs to be silenced’ (Lutzhof and Jacobson no date). The problem for seafarers is that for those who are alert and functioning a BNWAS may be precisely described as an ‘annoying distraction’ which offers no navigational assistance but requires ‘silencing’. In this context the temptation to silence the alarm permanently may be great. In the wider literature on alarm systems BNWAS may be regarded as akin to ‘low-urgency’ alarms. These are alarms which do not usually require urgent attention, or indicate imminent danger. BNWAS are curious in respect of the fact that seafarers are required to prevent activation of the alarms on a regular basis and that this is a necessary but not an ‘urgent’ task. Once an alarm is activated there may of course

be a need for immediate action. Bliss, *et al.*, (1995) in a study of responses to alarms of different urgency found that low-urgency alarms were responded to less frequently and more slowly than urgent alarms. In the medical setting, Edworthy and Hellier (2005) suggest that such alarms are regarded as irritating and may actually interfere with the conduct of a task. Block, *et al.*, (1999) found that, as a result, anaesthetists often switched off such low-urgency alarms.

The irritating nature, and low importance of such alarms, may explain why there have been a number of reports of the watch alarm being disabled on ships in transit. In 2008, for example, the general cargo ship *Antari* went aground off the coast of Larne in Northern Ireland. The officer of the watch had been asleep for over three hours on the bridge when the vessel grounded and the accident investigation report notes that the ‘watch alarm was not switched on’ (MAIB 2009). In a similar but rather more complex incident the Captain of the vessel *Karin Schepers* fell asleep on 3<sup>rd</sup> August 2011 resulting in his vessel grounding off the Cornish coast two hours later. Like the *Antari* the vessel was equipped with a bridge watch alarm but this was switched off. The report notes that ‘A BNWAS was fitted on *Karin Schepers* but it was not turned on at the time of the accident, and evidence indicates that it had not been used for several months’ (MAIB 2012: 12). The report continues:

The requirement to carry a BNWAS was confirmed by the International Maritime Organization (IMO) in amendments to SOLAS Chapter V, Regulation 19, effective 1 January 2011. The amendment gives dates by which various vessels must have fitted a BNWAS, and states that it shall be in operation whenever the ship is underway at sea. (ibid: 13)

However, in spite the evidence arising from cases where BNWAS might have prevented the occurrence of an incident BNWAS are not universally welcomed by seafarers who assert that not only may they be irritating they might even serve to distract watch keepers from their duties, especially in traffic-dense areas.

When they are used as intended, although such systems clearly deal with the problem of watch officers falling asleep they do not address the issue of why watch keepers might fall asleep. As such, these systems are identified as addressing the symptoms of the problem but not the problem itself (*Lloyd’s List*, 2007). Drawing on research evidence, Michael Grey (2011) suggests that boredom and fatigue are two factors which may make watch

keepers sleepy. In addition, it is argued that the increasing level of automation on-board de-skills seafarers and changes their role from active navigators to passive monitors (Grey, 2011; 2012). This can make watch keeping boring, especially in open sea, where ‘traffic’ is sparse. Automation can also be seen to have allowed for the reduction of crewing levels. Smaller crews mean that in periods of intense activity there may be overload experienced by some crew members. In an ethnographic study of seafarers, for example, Sampson notes that chief officers often work very long hours in port (Sampson, 2013). This means that periodically, seafarers may not have enough time for rest, which ultimately may cause fatigue. Furthermore, smaller crews may make it less likely that an AB is posted on the bridge as a watchman during the hours of darkness (a practice advocated by some maritime administrations). Several accident investigation reports have noted that the presence of a watchman would have served to dramatically reduce the chances of a watch keeper falling asleep in the first place and would certainly have reduced the possibilities of such an event passing unnoticed.

The example of the BNWAS thus provides us with further information about problems that can arise in relation to the use of mandatory equipment. Here mandatory equipment may be characterised as being used in an attempt to address a problem once it arises when more effective strategies could be employed to prevent the problem arising in the first place. This may undermine the commitment of operators to the effective use of the equipment. Furthermore the literature, relating to both BNWAS systems and other low-urgency alarms, demonstrates that where operators find equipment an irritating and unwelcome distraction, and where they regard it as being of little functional assistance to them in their jobs, they may choose to disable the equipment (in this case to switch it off).

### **Oily Water Separators**

Oily water separators allow cargo vessels to segregate oil from waste bilge water and in line with MARPOL regulations to discharge water with an oil content of less than 15ppm (parts per million) directly into the ocean. Remaining oil residues are required to be stored on-board until such time as they can be transferred to reception facilities ashore, or incinerated. The MARPOL convention requires ships to keep an Oil Record Book (ORB) in which OWS usage and oily waste disposal are recorded.

Although the installation and operation of OWS has been mandatory since the 1970s, there are enduring problems with the use (and abuse) of oily water separators. It is an open secret within the industry that some seafarers continue to discharge bilge waste directly to the sea through a so-called ‘magic pipe’ bypassing the OWS that has been installed on-board. In 2012, for example, the operators of the vessel *M/V Susan K* were ordered to pay a substantial US\$1.2 fine having been found guilty of using a ‘magic pipe’ to discharge oily bilge waste water over-side. According to an on-line report:

The chief engineer and other crew members on-board the vessel repeatedly discharged oily bilge waste water from the vessel into the ocean from before Aug. 1, 2011, to March 4, 2012, by using a hose that bypassed the vessel’s OWS, aka a “Magic Pipe”. The chief engineer then falsified the vessel’s oil record book to conceal the dumping from Coast Guard inspectors when the vessel entered the U.S. ports in Alaska on Jan. 24, 2012, and then in Houston on March 4, 2012. (<http://gcaptain.com/german-shipowners-plead-guilty-in-magic-pipe-case/> accessed June 17<sup>th</sup> 2013)

As a result, of the continuation of such violations, port states have tightened up their surveillance and prosecution of such MARPOL infringements. As early as 2006, US Department of Justice statistics showed that shipping companies had been fined \$145m, and that seafaring staff had been sentenced to a total of 18 years’ incarceration for falsifying ORB records and using ‘magic pipes’ (Joshi, 2006). Similarly, European and Canadian courts also levied high fines on shipping companies whose ships illegally discharged oily waste overboard (Gale, 2007). However, as the case of the *Susan K* demonstrates infringements of the MARPOL regulations continue.

It is important to recognise that seafarers face prosecution as a result of the discharge of illegal waste overboard. They may also face long periods of time detained in the USA, or other prosecuting nations, whilst awaiting trial when accused of utilising magic pipes. This can certainly be understood to have a deterrent effect on seafarers. For example, it has been reported that some senior seafaring staff are increasingly reluctant to sail to the US at all for fear of criminal charges. Michael Grey (2010) recounted one ship manager’s complaint:

“A ship manager, who had come from marine engineering at sea not long before, told me that so much attention was now being given to the operation of the oily water separator by the engineering staff that the condition and performance of the engine had become almost secondary. Engineers, he said, were worrying themselves sick about whether a scrutiny of the oil record book

would reveal some deficiency and see them subjected to an interrogation not far short of torture by the US authorities. There were chief engineers who had gone sick rather than return to a ship bound for the US.”

This raises the interesting question of why infringements of MARPOL regulations concerning the discharge of oily bilge water continue to persist. As implied in the quote above there may be reasons that are not associated with the mandatory OWS itself but are associated with record keeping. However there may also be reasons why the operation of the OWS itself raises problems for seafarers. Like the lifeboat designs discussed hitherto there are many different makes of OWS on the market and not all of these are regarded as ‘fit for purpose’. OWS have been described as ‘crude’ technology, and one ship manager commented (LSM, 2007: 28):

“OWS, and incinerators, are still a ‘grey’ area. They are not governed by class rules with regard to capacity and quality ... they are often the last item on the ship’s specification. So often we are confronted with absolutely minimal equipment, which needs constant attention and a lot of man hours of a minimal crew to work the thing. It is basically not technology that should be on-board a ship, certainly not after a few years of use”

It is argued by many that some OWS only work ‘in theory’ i.e. in laboratory conditions where oil ‘sits nicely on top of fresh water’. It has been suggested that OWS may be less effective when required to filter bilge waste which contains thick sludge, emulsions, fuel oil, and detergent (Grey, 2006; *Lloyd’s List*, 2006). In these circumstances it may become impossible to discharge any water via the OWS when the system cannot effectively filter out impurities. Alternatively some OWS have been said to allow for the discharge of oily wastes that have combined with other substances and are no longer recognised by the system as ‘oil discharge’. It would seem that performance issues have dogged this particular example of mandatory equipment such that ship managers have complained that:

“Nobody condones the alteration of oil record books, nor do we excuse dumping of slops at sea, but ... when will we accept responsibility for requiring an OWS design with filters that do not require replacement every fourth day? How can we countenance continued and repeated OWS prosecutions by the US Department of Justice when the industry can’t get its act together on a technically effective, user-friendly design?” (Maitland, 2010)

Thus without the capacity to filter oily bilge water, and perhaps in the absence of management support ashore, the last resort left to a seafarer may be to dump it at sea illegally. A variety of issues may contribute to such decisions such as the provision of insufficient waste holding capacity on-board (Gale 2007), and the unavailability or expense of waste reception facilities ashore (Abou-Elkawam, 2011; Gale, 2007; Grey 2006; Maitland, 2010).

Reasons for OWS violations not only relate to ‘hardware’, however, and it has also been suggested that ‘human factors’ contribute to continued MARPOL violations. For example, poor training may be being provided relating to both the operation and maintenance of OWS. There may also be poor supporting literature provided by OWS manufacturers to operators (operator manuals on-board). Furthermore, such problems might be combining with an increased complexity associated with the equipment (*Lloyd’s List*, 2006). Additionally, and as with the operation of lifeboats, fear may be a factor here. If seafarers are sufficiently afraid of making a mistake with the operation of OWS they may be resistant to training and fearful of operating the equipment at all – perhaps resorting to magic pipes. Finally, some authors have suggested that the occupational culture associated with shipping is to blame. Features of such a culture are considered to include: an ethos of not reporting problems or ‘making a fuss’ but instead ‘making do’ with whatever is available at sea (Grey, 2006; *Lloyd’s List*, 2008; Olney, 2007); not challenging senior people (Gale, 2007; Olney, 2007); and perhaps an attitude that ‘dumping is OK’ so long as you don’t get caught (Gale, 2007; Joshi, 2006).

Thus the example of the OWS offers us more threads to pursue in our understanding of the variety of reasons why mandatory equipment may be poorly used on-board. Here we can add the occupational culture of shipping to the aforementioned issues which included poor design, maintenance, and training.

## **Conclusions**

In this paper we have highlighted some of the issues that may impede the effective use of mandatory equipment by seafarers. These include: technical design; training; maintenance; motivation; fear; the perceived usefulness of equipment; occupational culture; and crewing practices. There will undoubtedly be an opportunity to develop our

understanding of some of these issues in the course of our forthcoming fieldwork as well as to consider other, new and emergent, ideas.

This paper is exploratory and will aid researchers in their future fieldwork. Nonetheless, though partial and preliminary, it serves to highlight a variety of challenges that the maritime industry faces with regard to the use of mandatory equipment. Once the research is completed we hope the findings will allow companies to make changes (as required) to a variety of practices and procedures pertaining, both directly and indirectly, to the use of mandatory equipment in order to maximise its effectiveness on-board.

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# The Governance of Ships' Sulphur Emissions: Issues of Enforcement and Equal Treatment

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## Abstract

Uncontrolled emissions from international shipping have been the single most important contributor to 'acid rain' in Northern Europe and have resulted in an estimated 27,000 premature deaths per annum (including deaths of retired seafarers) across Europe. Accordingly, progressive controls on sulphur levels in fuel were introduced in the Emission Control Areas of the Baltic (2006), the North Sea/English Channel (2007) and coastal North America in 2012. This paper draws on observational data from 16 Port State Control inspections in the UK and Sweden, 50 semi-structured interviews with international and national regulators, surveyors, fleet managers, industry associations, class societies, port management, bunker suppliers, trade unions, environmental NGOs and other stakeholders, and also on unpublished statistical data relating to laboratory testing of fuel samples. Although it is widely accepted that Port State Control has been a broadly effective instrument for the enforcement of international shipping regulations, at least in the Paris MoU region, enforcement of the new sulphur regulations poses a new critical challenge, since the rewards for non-compliance (in the shape of lower fuel costs) are substantial. Compliance rests in part on the perception that non-compliant competitors will be detected and sanctioned. The paper identifies several current barriers to detection of non-compliance and argues that future effective enforcement may depend on the extension of current limited programmes of fuel sampling and testing.

## Introduction

Uncontrolled emissions from international shipping have been the single most important contributor to 'acid rain' in Northern Europe (Mellqvist and Berg, 2010). In a study conducted for the International Maritime Organisation, Corbett et al. (2007) estimated that the fine particulate matter emitted from vessels burning high sulphur fuel was causing 27,000 premature deaths per annum across Europe from pulmonary and other diseases. It should be remembered that, while this fine particulate matter does not fall on the decks of the emitting vessel, seafarers in busy harbours and seaways, such as Rotterdam and the English Channel, are exposed to fine particulate matter emitted by other vessels in the area: retired seafarers are

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likely to be disproportionately represented among those suffering premature deaths as a result of uncontrolled emissions.

IMO regulations on sulphur content in fuel came into force in 2005 and were revised in 2010. The world-wide sulphur cap was initially set at 4.5%, reducing to 3.5% in 2012, with a projected further reduction to 0.5% in 2020. This last 2020 deadline is subject to a planned review and could be postponed until 2025. Additionally, IMO set up Emission Control Areas (ECAs) in the Baltic (from 2006), the North Sea/English Channel (from 2007) and North America (from 2012). Initially, the sulphur limit for the ECAs was set at 1.5%, reducing to 1.0% in 2010, and due to reduce further to 0.1% in 2015. There are also regional, national and local restrictions on sulphur levels. The EU has introduced restrictions on sulphur levels for passenger ships in EU waters and restrictions on the sulphur levels of fuel that can be burned in EU ports and harbours. Sweden's 'fairway dues', charged to cover the costs of ice-breaking and navigation lights, are differentiated to reward vessels continuously using low sulphur fuel, and Swedish ports operate similar environmentally differentiated charges. California also has restrictions on fuel sulphur levels in ports and coastal waters.

It is possible to point to a number of shipping operators that have sought to position themselves in the market-place as environmentally responsible companies. Swedish ferry operators discharge all their toilet waste ashore, although regulations do not oblige them to do so. A number of operators, including BP Shipping and Maersk Line, have joined Forum for the Future and WWF to form the Sustainable Shipping Initiative, whose goals include 'dramatically reducing greenhouse gas intensity' (Sustainable Shipping Initiative, 2011). However, compliance with the IMO and EU environmental regulations on sulphur entails very considerable costs. At the time of writing (April, 2013), the price difference between 3.5% sulphur fuel oil and 0.1% sulphur marine gas oil (distillate) was around \$150 per tonne; the price difference between 3.5% sulphur fuel oil and 1% sulphur fuel was around \$12 per tonne (in early 2011 this differential leapt to \$80 per tonne, following disruption of supplies of low-sulphur Libyan oil). The car carrier operator, Wallenius Wilhelmsen, has chosen to operate a global low-sulphur fuel policy since 2005; the company estimated that, in 2009, this policy cost an additional \$2.7 million (Wallenius Wilhelmsen, 2011). Fuel costs are already greater than crewing costs for operators of non-passenger vessels, and the additional costs of complying with the IMO and EU regulations have occurred at a time when operators are facing falling freight rates and operating losses: in early 2012 the Baltic Dry Index, which measures short-term freight rates for the bulk carrier sector, dropped to the lowest point in its

26-year history (Norris, 2012). Thus, the financial incentives to evade compliance with the sulphur regulations are very considerable, dwarfing the potential savings to be made by, say, evading the safe manning regulations. Providing effective enforcement of the sulphur regulations is thus a critical test for the international governance of the shipping industry.

This paper reports on the findings of a comparative study of the enforcement of the sulphur regulations in the UK and Sweden (grant reference RES-062-23-2644). A number of problems with enforcement practice are identified which militate against effectiveness, although conscious evasion of the regulations is currently surprisingly low – a situation which seems unlikely to persist unless enforcement practice changes.

## **Methods**

The data comprise observational data on 16 Port-State control ship inspections in Sweden and the UK, and 50 audio-recorded, semi-structured interviews with Port-State Control Officers, officials of national and international regulatory agencies, and industry stakeholders representing a wide range of interests (fleet management, industry associations, bunker suppliers, classification societies, port management, trade unions and NGOs concerned with shipping and the environment). In addition, several unpublished datasets were collected on statutory fuel sampling and testing, commercial sampling and testing, and bunkering activity. The interviews were transcribed and the transcripts and the observational fieldnotes were both indexed (using the same index codes) and systematically analysed using analytic induction (Bloor, 1978).

## **Compliance levels**

Although commercial testing of fuel samples is commonplace, there are no published data on the total numbers of samples and tests taken for statutory purposes. We estimate that for ocean-going vessels in European ports (as opposed to inland waterways) the total number of statutory tested samples is only around 500 per annum: Sweden and Germany supply the majority of these, with smaller contributions from the Netherlands and Denmark. To put this figure in perspective, it would comprise only 2.6% of Paris MoU Port State inspections in

2011 (Paris MoU, 2012). The 86 test samples taken in Rotterdam in 2011 (Vink, unpublished) would only comprise around 0.1% of all arrivals.

With such a small number of statutory samples tested, it is difficult to be specific about the levels of compliance with the sulphur regulations. But the indications are that a large majority of vessels are compliant. Of the 86 Rotterdam vessels, 14 vessels (16%) were found to be non-compliant (ibid.). The Swedish Maritime Administration has kindly made available the results of tests on the sampling they undertake as part of the enforcement of their environmentally differentiated fairway dues: allowing for a margin of error in sulphur content of  $\pm 0.05\%$ , samples from 149 vessels in 2010 yielded only 6 vessels (4%) with non-compliant fuel oil. One might expect compliance levels to be higher in Swedish ports than in Rotterdam: the Swedish testing programme has been running since 1998 and a higher proportion of vessels trading in and out of Swedish ports are likely to be continuously operating in the Baltic and North Sea ECAs. Further confirmation of the Swedish data is provided by an academic report on laser equipment mounted at the entrance to the port of Gothenburg in 2007: analysis of the exhaust plumes of 80 individual vessels found 3 (i.e. 4%) to be non-compliant (Mellqvist and Berg, 2010). Further geographical variations in compliance may exist (for example, between Mediterranean and Baltic ports in levels of compliance with EU regulations on sulphur levels in fuel burnt in port), but sufficient statutory sample testing evidence is lacking.

Many operators routinely dispatch bunker samples for commercial testing. In the absence of large-scale statutory testing, these commercial test data are a valuable research resource, although it must be recognised that ship operators who are deliberately flouting the regulations are hardly likely to be sending samples for testing. Michael Green of Lintec Ltd has kindly supplied us with test data for 2011: 2.7% of West European bunker samples were off-spec for sulphur (within this figure, the proportion of off-spec Rotterdam samples was 2.3%), and 1.4% of Baltic bunker samples were off-spec.

### **Reasons for non-compliance**

The Lintec data clearly indicates that one (but not the only) reason for non-compliance was that off-spec fuel was supplied by the bunkerer. This may occur through a phenomenon known as ‘stratification’: 1% sulphur fuel oil is obtained by blending residual fuel oil with

distillate – partial separation of the fuel and distillate may then occur in storage, to result in off-spec fuel.

Another reason for non-compliance to occur lies in faulty changeover procedure on vessels switching from high sulphur fuel oil to low sulphur fuel when transiting the ECA. Meindert Vink of the Netherlands Human Environment and Transport Inspectorate, who kindly supplied us with the Rotterdam statutory test data, believes that this is the commonest cause of non-compliance. Although expert advice on changeover procedures is available from organisations such as Lloyd's FOBAS, it is clear that actual changeover practice differs substantially between similar vessels and between different chief engineers on the same vessel. The following fieldnotes from an observed port-state inspection provide an illustration:

‘The chief engineer followed a 4-hour changeover procedure, which he began 8 hours steaming time from the ECA boundary. He remarked that he had noticed that his predecessor as chief had previously followed a 6-hour changeover procedure’.

That vessel had three service tanks serving the main engines, one service tank for each type of fuel carried. Changeover procedures are much more problematic when a vessel has only one service tank and therefore compliant fuel may be contaminated by a residue of non-compliant fuel remaining in the service tank. Here the fieldnotes on the changeover procedure for a vessel with a single service tank record that:

‘Their changeover procedure specified part-emptying the settlement tank (upstream from the service tank) for 4 days and flushing through the service tank. The capacity of the settlement/service tank was 17 cubic metres and each day they emptied out 4 or 5 cubic metres. The main engines took 0.55 cubic metres of fuel per hour (i.e. 13 cubic metres every 24 hours).’

However, despite this seemingly rigorous procedure, it was quite possible that the vessel was actually operating on non-compliant fuel because the low-sulphur fuel oil used for flushing/dilution was itself 1.0% sulphur, so only a tiny amount of remaining high sulphur fuel oil would be required to put the post-changeover fuel over the statutory limit. A dry dock manager we interviewed stated that his company and other European dry dock facilities were experiencing a high demand for the retro-splitting of service tanks on single-service-tank vessels – testimony to the difficulties operators of such vessels are facing in achieving compliance.

Stratification and faulty changeover procedures might both be termed inadvertent reasons for non-compliance, but regulatory avoidance (by the bunkerer or the operator) also plays part here, as is implicit in the substantial differences sometimes found in statutory testing between the test results and the declared sulphur level on the Bunker Delivery note. The Grande Mediterraneo (IMO no. 9138393) inspected in Wallhamn, Sweden, on 10/11/2010 was found to have been burning fuel oil with 1.68% sulphur, while the Bunker Delivery Note recorded 0.98% sulphur.

### **A culture of compliance?**

It should be no surprise that some regulatory avoidance is occurring, particularly given the substantial cost advantage associated with operating with non-compliant fuel. The surprise might perhaps be that deliberate regulatory avoidance is not more common. In recent years, the evidence from Paris MoU port-state inspections is that a culture of compliance has developed among ship operators. In 2001, the proportion of vessels detained following Paris MoU inspections was 9%. In 2011, the targeting system for Paris MoU inspections changed, so the last year in which inspections can be compared with 2001 figures was 2010: in that year, the proportion of inspections resulting in detentions (for all causes) was just 3% (Paris MoU, 2011). Compliance levels are probably greater amongst vessels trading in and out of European and North American ports than in some other parts of the world, compliance levels also vary by type of regulation (with compliance with labour and health and safety standards probably being relatively poorer), levels vary by sector (with the tanker sector, for example, more compliant than the bulk carrier sector), and levels vary within sectors - with some operators seeking to position themselves as blue riband carriers (Bloor et al., 2013). Nevertheless, a fall in detentions from 9% of inspections to 3% of inspections speaks for itself.

However, as our interviewees repeatedly emphasised, regulatory compliance in the shipping industry is conditional: it is conditional on operators perceiving that regulatory enforcement is sufficiently effective to detect and punish non-compliant competitors. Thus:

‘We don’t have a problem with enforcement because we fully comply. *And we expect everyone else to fully comply.*’ [ship operator, emphasis as in the original]

‘We will not invest in [scrubbers] technology unless there is compliance with [fuel] regulations ensured by all the other companies.’ [ship operator]

‘...the industry wants enforcement because we don’t want people cutting the corners. So all the good ship-owners want everybody else to be paying the same price’. [shipping industry representative]

There is a Gresham’s Law of the Sea: bad ships drive out good (Bloor et al. 2006). Unless operators are in a niche market, in the long run, they cannot afford to comply with expensive fuel regulations unless their competitors are similarly compliant. There is a general desire in the industry for a ‘level playing field’, but it is a moot point whether current enforcement practice is sufficiently rigorous to secure that level playing field in respect of the sulphur regulations.

### **Problems of enforcement practice**

As we have seen, statutory fuel sampling-and-testing only occurs very rarely. Standard enforcement practice in port state inspections in the UK and Sweden is checking the sulphur levels in the Bunker Delivery Note (BDN) and to check the recording of fuel changeovers in the Oil Record Book. Such checks need not be carried out at every inspection. It is frequently stated that Port State Control is ‘a sample, not a survey’, and so some checks may be omitted in a ‘light touch’ inspection.

The problems with reliance on the BDN and the Oil Record Book are several, but even when statutory sampling-and-testing occurs, effective enforcement may be problematic. The sampling-and-testing procedure followed in Rotterdam ensures receipt of the test results within three hours of sampling, allowing detention of the vessel. In contrast, the procedure in Sweden is such as to only yield the test results after the vessel has departed. In respect of the Swedish fairway dues, a non-compliant test result leads to the disqualification of the vessel for reduced dues, but in respect of the IMO regulations, the Swedish authorities typically undertake only to notify the flag-State of the departed vessel’s non-compliance. Such notifications do not always receive a reply.

Where detentions occur, they gain much of their deterrent effect by their publication on the Paris MoU THETIS website, and their subsequent re-publication on industry websites such as Equasis. This ‘naming-and-shaming’ of the non-compliant vessel has an immediate impact on the freight rates that the vessel can command from charterers. However, the THETIS website



only records detentions as a result of non-compliance with IMO regulations: failures to comply with the 0.1% EU port fuel regulations are not recorded on THETIS and Equasis.

Turning to the BDN and the Oil Record Book, as a number of interviewees pointed out, neither of these documents was designed to have a statutory purpose and it is debatable whether they are robust enough for such a purpose. Both are frequently hand-written and vulnerable to forgery and fraud. The ship's copy of the BDN is a carbon copy and frequently unreadable, particularly after storage. Bunker suppliers must be registered and withdrawal of registration represents a possible sanction for wrong-doing, but the bunkerer registration number does not appear on the BDN. The BDN is not always in English: it is expecting rather a lot of inspectors to know that 'zwavel' is the Dutch for 'sulphur'. And in many smaller ports the bunkers (and the BDN) may be delivered by sub-contractors with little knowledge or interest in the regulations.

Port State inspectors can board vessels from pilot boats, but most inspections take place when a vessel is berthed. Although experiments have been taking place with remote monitoring of emissions by use of laser technology, it is not currently practicable to enforce the sulphur regulations on non-berthing ships that are merely transiting territorial waters and ECAs. Relatedly, port state inspections are not particularly well-resourced and are subject to budgetary restraints in several countries. The UK's Maritime and Coastguard Agency has to find cuts of 22% over the period 2011-2015 (Massey, 2011). This militates against investment in, and deployment of, technological aids which could increase effective enforcement. For example, portable, laser-based testing kits are commercially available (and routinely used by refineries) and could, in principle, be carried on-board as part of a port state inspection, but the kits currently retail at around £30,000 each.

Finally, it should be noted that effective enforcement itself carries potential dangers to vessels with single service tanks, where the changeover procedure entails partial drainage of the service tank. There is a consequent danger of engine breakdown where the operation is poorly conducted: the tanker *Overseas Cleliamer* reportedly came close to grounding at the entrance to San Francisco Bay, due to engine breakdown while undertaking a fuel changeover (*Lloyd's List*, 2011).

## **Conclusions**

At present, compliance levels are high and most non-compliance is inadvertent, rather than the result of conscious regulatory avoidance. However, the potential rewards for non-compliance, in the shape of lower fuel costs, are considerable. The current ‘culture of compliance’ is unlikely to continue into the future unless operators believe that a ‘level playing field’ is being effectively enforced on their competitors.

However, it is doubtful whether, in European ports, current enforcement is sufficiently effective to secure that level playing field. This, it seems, is also the recently expressed view in Brussels. The revised European Parliament and Council Directive of 21/11/2012, paragraph 17, states:

‘...there is a need for a stronger monitoring and enforcement regime [...] it is necessary that Member States ensure sufficiently frequent and accurate sampling of marine fuel placed on the market or used on-board ship as well as a regular verification of ships’ logbooks and bunker delivery notes’ (Official Journal of the European Union, 2012).

It appears that Member States will be required to undertake a step-change in enforcement practice.

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# **Supply Chain Leverage and Health and Safety Management in Shipping – the Case of the Container Trade**

*David Walters & Helen Sampson*

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## **Abstract**

In recent years, discourse on occupational health and safety management has been increasingly concerned with drivers of good practice. In this respect, it is suggested that alongside public regulation, there are various ways in which business relations involved in the supply of goods and services can act as leverage in improving arrangements for health and safety management.

The wider literature on the features of supply chain relations would lead us to anticipate that for buyers to be able to exert an influence on the management practices of their suppliers they first need to see it as in their best interests to do so and second, certain conditions need to prevail, to enable their influence to be effective. Similarly, the wider literature on regulation argues that ‘smart regulation’ could, under certain circumstances take advantage of influences within these private business relationships to promote regulatory compliance.

We have examined the role of these relations in the maritime industry, as part of a larger study which looked at their influence in situations in which they might be anticipated to occur (such as in the oil tanker trade), and in others in which pre-conditions for their effectiveness were less obvious. In this latter case in the maritime industry, we focused on the container trade and in this presentation we discuss our findings on what happens in a situation in which it is not immediately obvious that the priorities of the business interests involved, or the nature of the supply relationships concerned, would work towards assuring that there were systems in place to promote good practice in health and safety management.

## **Introduction**

Evidence of occupational mortality and morbidity indicates that relative to other occupations seafaring remains among the most dangerous. Although there have been undeniable improvements over time, the health, safety and welfare of seafarers continues to be an issue of concern about what are largely preventable losses.

A greater incidence of occupational injury and ill health in one economic sector relative to others suggests both the presence of high level of risk and also that the system for managing this risk may not working as well as it could. Acknowledgement of the latter usually prompts

attention to regulation. History is replete with inquiries that have found fault with regulatory measures and called for their improvement. The maritime industry is no exception in this respect and the International Safety Management Code (ISM) itself was a product of such concern. Its adoption during the 1990s brought the industry into line with many other sectors in which a similar approach to *regulating the process* of managing occupational health and safety (OHS) was already in evidence.

A key issue for all sectors however is not only the nature of regulation but also what drives compliance with regulatory standards. In recent years, the wider discourse on regulatory arrangements to improve occupational health and safety practice and outcomes has increasingly concerned itself with this issue. As a consequence, not only has there been a shift in regulatory policy from prescriptive to process based regulation—such as exemplified by the ISM Code, where arrangements to *manage risks* are emphasised—there has also been a search for alternative approaches to traditional command and control methods to achieve implementation and surveillance of regulatory requirements on occupational health and safety.

While the literature takes many different positions, a common standpoint is that to achieve the desired results, regulation needs to be more ‘responsive’ (Ayres and Braithewaite, 1992), ‘smarter’ and to build more on the voluntary engagement of companies in managing health and safety risks. In this respect generally, both in policy and in the (largely) theoretical discourse that helps to inform it, the central understanding of the role of institutions of public regulation has shifted somewhat so that these institutions are no longer seen as pivotal, but more as components among ‘many closed self referential sub-systems seeking to use indirect means to achieve broad social goals’ (Walters et al, 2011:56). In the light of this, a need is seen for new organisational forms for regulation that are capable of bridging the gap between the state and the market.

In both the policy and academic literature it has been argued that there are various ways in which business relations involved in the supply of goods and services may act as leverage in improving arrangements for health and safety management (see Walters et al, 2011 ). It is with achievement of such leverage and the wider institutional environment in which it is most effectively situated and supported in the maritime industry that the present paper is mainly concerned. That is, we are concerned to understand the role of supply chain leverage in promoting health and safety management at sea.

The paper draws on interviews and informal discussions, which took place in the course of a research project funded by the Institution of Occupational Safety and Health (IOSH). This wider study also included research on the construction industry and the tanker trade in the shipping industry and was reported in 2012 (Walters et al, 2012). Some of the early findings on the tanker trade were also reported in a paper presented at the last SIRC Symposium. This present paper is based specifically on the analysis of interviews conducted in the shore-based offices of a vessel manager (8) operating a small fleet of container vessels trading between the USA and Europe, and a representative of a shipping association connected with the broader container trade. In addition it utilises a range of interviews (14) and informal discussions which took place aboard one of the container vessels operated by the company.

In the following account, we first briefly explain what we understand by ‘supply chain relations’ and what we already know from research concerning their influence on arrangements for managing health and safety at work. We then examine the nature of these relations in the container trade in shipping and discuss the experiences of ship managers and seafarers in our study, concerning what they regarded as important regulatory influences on their compliance with requirements on the management of health and safety at sea. We situate this discussion in the wider context of current discourse on ‘what works’ in regulating health and safety at work.

### **Regulating health and safety at sea and the role of supply chain leverage**

Supply chains (or value chains) describe the business relationships involved in procurement and delivery of goods and services. They may involve simple buyer/supplier relationships between two entities or more commonly, quite complex chains or networks of transactional relationships in which numerous organisations may be involved in various business relationships between production and use. Business organisations are frequently simultaneously both buyers and suppliers. As modern business methods associated with the globalised economy have grown in prominence, so too has the interest in supply chain management and the price and delivery demands dominating transactions between organisations. Current business and organisational practices such as downsizing, outsourcing, just in time management, lean production and so on, have further served to increase the importance of supply chains within business relations at both national and global levels.

In shipping there are a complex array of such relationships built around the provision of a service in the transportation of goods. However, as is well known, the nature and extent of outsourcing in modern shipping makes for a complex set of business relations to the extent that the relationship between the purchaser and the provider of a maritime transportation service is seldom direct or simple.

As businesses try to manipulate features of their supply chains to improve their profitability, efficiency and market position, the question of what happens to the health and safety conditions of workers affected by these strategies has become a focus for attention and debate among OHS regulators and regulatory scholars. Current discourse reveals two very different effects on preventive health and safety arrangements. Thus, on the negative side, many studies demonstrate that the pressures of outsourcing and the price and delivery demands of powerful buyers, often generate ‘indirect’ adverse effects that cause OHS standards to deteriorate among suppliers (Quinlan et al, 2001; Quinlan and Bohle, 2008 and Walters and James, 2009 for reviews of these studies). Meanwhile, on the positive side, occasionally the same supply relations can be used to enhance, rather than undermine, health and safety standards, especially within supplier organisations. That is, scope exists for powerful supply chain actors to use the market power at their disposal to improve OHS management among their suppliers. They might do so for example, by laying down contractual requirements as to how this management is to be undertaken by contractors and by taking action to monitor and enforce compliance with these requirements, while threatening the withdrawal of their business should the supplier fail to meet them. Examples of such practices have come to feature significantly in discourse around public/private regulatory strategies to improve labour standards, including those on health and safety in globalised production.

However, as Walters and James 2009 demonstrated (and Walters et al, 2012 confirmed) these positive effects depend on the presence of certain pre-conditions. They are for example, likely to be crucially affected by the characteristics of the goods and services provided, the objectives and wider business interests of buyers and sellers, as well as by the distribution of power between them, and the institutional (including regulatory) context within which buyer-supplier relations are developed. They have been shown to work best in supporting improved OHS management when they are backed by adequate monitoring and penalty regimes; where the relationship between buyers and suppliers is a direct one in which they have worked together satisfactorily, for a relatively long time, and where the wider institutional context is supportive of them.

Conversely, buyer attempts to influence supplier health and safety management are less successful where they: (a) clash with the business interests of suppliers; (b) where such suppliers regard the risks of failing to comply with them to be relatively low; and (c) where the nature of the supply relationship between buyers and suppliers is indirect, distant, transactional or complex.

In the shipping industry, the most obvious example of the type of situation in which positive effects on health and safety are the result of supply chain influence is found in the oil tanker trade, where through the Ship Inspection Report Programme (SIRE) operated by Oil Companies International Marine Forum (OCIMF), the major oil companies, are able to keep the OHS management standards they require from the independent tankers companies that carry their oil under surveillance with regular SIRE inspections. As a result the tanker companies and their seafarers are left in little doubt concerning the need for compliance if the business of the oil majors is to be retained. This was described in a previous symposium paper (Walters, 2011) and more fully in the final report of the research, on which it was based (Walters et al, 2012). It indicated that from the perspective of both the managers of the companies involved and the seafarers that crew their ships, the arrangements provide powerful leverage for the achievement of compliance with the standards of health and safety management required by the oil majors (see also Bhattacharya and Tang, 2012).

The interest of the oil majors in ensuring this occurs is bound up with their awareness of their reputational and regulatory risks (especially in the case of environmental regulation) where failure would mean the possibility of serious and long term financial losses through the loss of cargo, large-scale environmental pollution damage, penalties and associated loss of business. The connection between the oil companies at the head of the supply chains involved and the independent tanker companies that carry their goods is both direct and dependent, thus allowing the relatively straightforward exercise of influence of one over the other.

A somewhat similar system operates in the case of chemical tankers (see Xue 2012). But elsewhere in the shipping industry more complex business relations exist. In these situations therefore, the question of the role of supply chain influences is likely to be less straightforward. In the container and in general cargo trades for example, the structural arrangements described above do not generally occur and business relationships between the owners of the goods carried, their shippers and the companies and individuals with responsibility for managing of health and safety on-board ships, is far more diffuse. It



therefore seems important to inquire as to what, if any, is the ‘positive supply chain effect’ in these scenarios

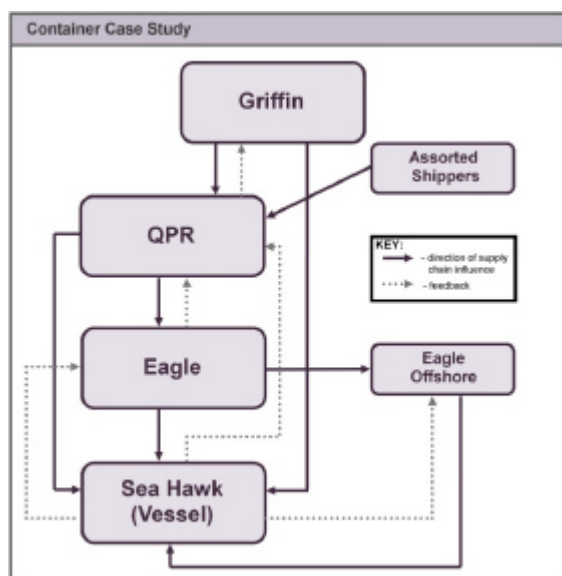
### **Supply chain influence and health and safety management in container and car shipping**

The case study on which this paper is focused is based upon a cluster of companies connected to a ship management company based in the UK that we have called Eagle Shipping. The supply chain in which Eagle Shipping was involved is shown in Figure 1. The business relations involved in the ownership, management and operation of its ships were somewhat complicated, and as our sectoral level interviews confirmed, fairly typical of those generally found in the sector. Griffin owned QPR who subcontracted ship management to Eagle. However, QPR retained the role of cargo management and in relation to cargo planning it had a direct relationship with the vessel, which did not run through Eagle channels.

Eagle Ship Management provided management for a modest fleet, which comprised vessels for two sister companies, and for QPR, which was a Swedish company. In total it managed fourteen vessels in a variety of trades.

The vessel on which the seafarers participating in the study sailed, was owned by QPR which in turn was owned by a large shipping line – Griffin. QPR was the major point of contact for Eagle management (for example, the purchasing manager liaised directly with them) while Griffin only played a role in a small number of areas, for example in relation to bunkering, which it wholly controlled. Eagle had held the contract to manage the vessels on behalf of QPR for around 18 months at the time of our investigation.

*Figure 1 Container Supply Chain Schematic*



On-board the ship QPR and Eagle were recognised by seafarers as having a strong association both with them and with operational matters. Griffin produced literature for all of its fleet, which was available on-board; but notwithstanding these efforts Griffin remained largely ‘off the seafarers’ radar’ except when it came to issues of fuel quality and bunkering. The seafarers were employed either by Eagle or its Philippines based crewing agency, Eagle Manila. Officers had permanent contracts but ratings did not. Rather unusually, all the seafarers were on rotations back to the same vessel.

While such complexities of ownership, management and operation are not uncommon in the maritime industry and also extend to practices in the tanker trade, the nature of the business relations between the companies and those whose goods they were transporting were quite different to those between the oil majors and independent tanker companies described previously. In the container and car shipping undertaken by QPR, goods belonging to a considerable range of clients could be loaded and carried on-board their vessels in any one voyage. The safety interests (if any) of the smaller of these clients appeared to have made little impact on the management and crew of the vessels, while those shown by larger clients were restricted to the conditions under which their goods were transported.

The safety of the cargo was reported by seafarers on-board to be the overwhelming concern of the cargo shippers (QPR’s clients).

“Well load it as fast as possible and get out of here, I have done my job now go home. [...] I don’t think they [the clients whose goods were being shipped] are really aware of this because they put their car on the dock and then the ship is gone and the car is gone. Of course they are checking that it is safe for the car of course, they have to do that.”

The seafarers perceived only limited interest in arrangements made for their health and safety among the owners of the goods that were being shipped. Instead, they generally saw the priorities of the clients as being focussed on getting the cargo in an undamaged condition from point A to point B as quickly as possible. Thus, they took an interest in the cargo holds, the lashings, and cleanliness, but generally this interest did not extend in any overt way to the arrangements for managing the health and safety of the crew. In this respect, the business relations between customers and the management and crew of the vessels carrying their goods were more typical of the arms-length trading relations that Sako (1992) argues are least likely to be characterised by features in which buyers exert a direct and significant influence over the internal management practices of their suppliers. There was no obvious pressure from the clients whose goods were being shipped for either the ship operator or the ship management companies to conform to any requirements concerning the management of health and safety on-board the vessels shipping them. Indeed, there was no evidence of them imposing such requirements.<sup>1</sup>

There were two primary reasons for this. One was because, beyond safeguarding their goods, there was no *immediate or obvious* reason why it was in QPR’s clients’ business interests to require particular standards of OHS management on-board the ships transporting them. The second reason was that the structure of the supply chain in question was too diffuse and the position of the clients whose goods were being shipped too remote, to allow processes, such as the procurement and monitoring activities found in the oil tanker trade to be used effectively to influence either the ship operators and managers or the seafarer working on-board the vessel we studied.

On the vessel, *Sea Hawk*, the overall view seemed to be that whilst some cargo owners dealing with QPR did take a certain interest in the vessel, this interest did not really drive

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<sup>1</sup> There was one customer that was regarded as an unusual/exceptional case. It had undertaken a more general auditing of the conditions of life and work on-board. This was described as useful by some seafarers and it was suggested that such practices sometimes picked up minor issues to be remedied. However, this was an exception and seemingly a spin-off from the particular corporate social responsibility agenda pursued by a large multinational retail company. It was remembered because of its exceptional nature rather than because it was in any way typical of the normal practices of customers.

standards forward or change things on-board. The seafarers thought that the priorities of QPR in acting on behalf of the cargo owners, to whom they provided a service, were about reasonable costs, speed of delivery, and avoidance of bad press.

Interviewer – And when they come do they speak to you? Are they interested in safety on-board?

Seafarer – Not totally, they are just only focused in the cargo. If they see something that is not good for the cargo then they will tell us.

Interviewer – So they are checking on the cargo?

Seafarer – Yeah, yeah.

Interviewer – Did you ever see anybody take an interest in the crew from the customers? Any of the customers take an interest in safety?

Seafarer – No they didn't actually

However, there were also signs that this was a relatively narrow expression of a more complex reality, since the seafarers were also aware that many relationships with shippers were longstanding and, to paraphrase a frequently aired view, 'if they keep coming back for more business then all must be well...' Effective safety management was regarded by both the personnel of the ship management company and the seafarers on-board the *Sea Hawk* as implicit in the maintenance of this business relationship. From the perspective of Eagle Ship Management for example, QPR — as the vessel charterer subcontracting to other customers to place their cargo on the vessels — wanted to show off a well run and safe fleet:

"The way I see the client we've got, I mean the client's men are boarding [names a European port] every time there is a wander round the ship as well,..... You know they want to show a vessel a reasonable standard to the customer because they have got to convince the customer to send their goods, and there are a lot of other shipping companies out there. But you can show your customer a nice clean well operated, well manned ship, well maintained he is more likely to send his goods with you than somebody who comes in with a manky [sic] old rust bucket hanging to bits. You know you are going to say are my goods going to get across the Atlantic?"

Aboard and ashore, reference was made to charterers visiting the vessels to inspect cargo holds and check on the safety standards relating specifically to the transport of cargoes:

"Oh yes, yeah. If any new contractor comes along he wants to ship his cargo out, he will go and visit the ship, especially if it is Ro-Ro, because he wants to know that the ship is not going to throw it about in the bottom of a hold and it is securely lashed

down and it is not going to move. We have had nothing yet that has broken away, they chain everything down, absolutely solid.”

These visits acted as pressures on the ship management company to demonstrate that it generally maintained high standards of management. Such high standards were part of its self-image and its business strategy. It was, for example, beginning to check that its own suppliers were International Organisation for Standardisation (ISO) 9008 and 14001 accredited, because there was a belief that clients might be concerned with such matters:

“And for the ISO 14001 this is because there is a bigger drive on us as a management company, a lot more clients that are taking the decision to be a bit more environmentally friendly, they realise that shipping gets a bit of a bad name for itself and we are just moving with the times. We are also now looking at, on 1 of the KPIs we’ve got, I think they say 5% of all our supplies should be ISO 14001 approved. So we are now going out to a lot of suppliers to cover those requirements as well.”

(MAN 1)

‘Good business sense’ also played a part in safety management on-board. In relation to procurement policies. For example, in relation to personal protective equipment (PPE — e.g. coveralls, boots, gloves) the company had decided to implement higher quality levels than required by minimum regulatory standards. In the case of coveralls the company spent some considerable time considering which higher standard coveralls to purchase. It searched for coveralls with greater fire retardant qualities because it was keen that these should meet the minimum requirement for their offshore vessels. This was partly because they wanted one supplier for all coveralls, but it was also because they were thinking about their public image:

“Plus also there is an element of corporate image as well, we want to maintain that, so we want to make sure the brands are on all our boiler suits as well, as well as the control on the quality.”

(MAN 1)

Generally managers seemed to feel the drivers for doing so were twofold: it was the right thing to do – to keep people safe, and there was also a business case for safety.

**MAN 2** – It is care for the individual and everyone else around, but the individual comes first. I mean you read any ISM manual and the master has overriding authority to save a life. Life comes first, safety at sea, SOLAS.

**Interviewer** – But there are other companies who have a different view?

**MAN 2** – There are, but within this company the promotion is, that is as [Person’s Name] says that is one of our selling points to the clients is we have a safety culture.

In short, therefore, while supply chain relations with the clients who shipped their goods with QPR in the ships that it had contracted to Eagle to manage did not themselves provide much in the way of direct influence on the OHS management standards that applied on-board, these relations nevertheless did ultimately influence conditions on-board, albeit indirectly. As the seafarers themselves pointed out, there was a perception in both Eagle and QPR that if their clients had cause to believe that their goods might be at risk as the result of the poor management of their transport, then they would take their business elsewhere. It was therefore important to QPR to contract the management of the ships it had chartered to a company whose standards of management were of suitable quality and, in turn, it was important to Eagle to be seen to be delivering this quality in the way it went about managing the ships. There was clearly a perception that safety management was an important element of managing affairs at sea. Indicators of the companies' standards in this respect, as well as avoidance of situations in which safety management failure might be identified were regarded as important to the continued business between QPR and Eagle. The business of the latter with its shippers was seen to be, at least to some extent, dependent upon the maintenance of these standards. There was also a sense among these companies, which were operating at the 'better end' of the market, that quality management was one of the indicators of competitive edge and therefore worthwhile pursuing from a business perspective. Again, since quality generally was associated with indicators of good safety performance, this was a further influence that helped to promote the company's efforts to maintain good standards of health and safety on-board ship.

However, as we explore further in the following section, it was also clear that these influences on the quality of OHS management did not operate singly, but were just one element of a set of influences in which both regulation and regulatory inspection were also important.

### **A constellation of influences?**

At first sight, our findings lend some weight to the notion that supply chain related business considerations helped duty holders such as Eagle Ship Management to regard their health and safety management strategies as part of their efforts to ensure good business. They strove to implement them for this reason, as to a lesser extent, did the charterers QPR. This occurred even though many of the preconditions for supply chain influence that we identified in the

previous investigation of the situation in the oil tanker trade (as well as in our wider review of land based scenarios) were not obviously present in the business relationships involved here (see Walters et al 2012 and Walters and James 2011).

Closer examination suggests a more complex picture of the dynamics behind these observations. In particular it demonstrates the role of the institutional framework in which the business relations are situated. This framework particularly included regulation and regulatory inspection and the strategies adopted by the regulatory bodies involved to achieve compliance. It was evident that managers in the cluster of companies we studied were aware of, and influenced by, this wider framework within which they focused their market-based attempts to improve business by demonstrating elements of good health and safety practice. The seafarers too, clearly felt that the regulatory environment in which they were embedded was particularly significant in influencing good practice on OHS. There were several examples of such areas of influence that featured prominently in our discourse with both managers and seafarers.

Adherence to regulation was repeatedly referred to as a priority in interviews with managers. The standard contract utilised (and often adapted) in the subcontracting of ship management, had several clauses addressed to regulatory compliance and to the management of safety. For example, one clause specifically mentioned regulation relating to seafarer qualifications (Standards of Training Certification and Watch-keeping (STCW)) and to the ISM Code. It states:

...the Managers shall in a timely manner make available, all documentation, information and records in respect of the matters covered by this Agreement either related to mandatory rules or regulations or other obligations applying to the Owners in respect of the Vessel (including but not limited to STCW 95, the ISM Code and ISPS Code)...

While another dealing with safety management systems required that:

Where the Managers are not the Company, the Owners shall ensure that Crew are properly familiarised with their duties in accordance with the Vessel's SMS and that instructions which are essential to the SMS are identified, documented and given to the Crew prior to sailing...

Eagle managers were aware of these regulatory standards and knew that their contract with clients made meeting them obligatory.

“No, no, no I mean I work for Eagle, but we all have our guidelines to work with and we have SOLAS, MARPOL, (loadline) and MED regulations and you have got to make sure you comply with all those. And we experience you know what is and what isn’t allowed.”

(MAN 2)

The desire to comply with regulations (or indeed, to work to higher standards) was not for fear of the cost of penalties for non-compliance but was more particularly out of a concern for business reputation. In this sense, therefore, charterers did become important. As one Eagle manager explained:

**MAN 4** - Because effectively these days, I don’t know if you know the Paris MOU and the company calculator, because whatever ships you have directly reflects on the company rating.

**Interviewer** - So you are very much trying to avoid deficiencies and detentions?

**MAN 4** - Yeah, which is exactly what, what the client wants anyway, whatever they say

**MAN 4** - So we offer the best. The best practice that we can.

This said, there was little doubt that because of the Flag under which the ship was registered, in combination with its trading route, in practice the public regulatory regime to which the ship was subject was seen as especially rigorous. The ship was registered in Sweden and plied a transatlantic route, which meant it was often subject to scrutiny by the US Coast Guard and European Port State Control authorities. This combination of comparatively strict Flag State and Port State regimes meant that both managers and seafarers believed inspection played important roles in maintaining a focus of OHS management standards for both the companies and the seafarers involved. They regarded inspection as important and both ashore and on-board there was a significant tendency to want to conform to regulation, coupled with a belief that non-conformity would be discovered. The seafarers were also aware of the presence of public authority inspection, and while regarding it as burdensome in many respects, they nevertheless saw it as in their interest and ultimately beneficial.

A further effect of inspections was to encourage the double-checking of items that should be checked at regular intervals on-board according to the Safety Management System (SMS). For example, life saving equipment was supposed to be subject to regular weekly and monthly checks but preparation for inspections had been sufficiently thorough to uncover some oversights in the past.



Compliance with regulatory regimes was seen as a priority because of the likelihood of one form or other of inspection by the public authorities. This regulatory inspection environment contributed significantly to the maintenance of high standards of health and safety management on-board. However, within the general framework of a comparatively rigorous public regulatory environment, there was a further element that was especially significant in its contribution to supply chain pressures for improved OHS management. This was the effect of the ‘smart’ regulatory regimes adopted by regional associations of Port States. Managers were aware of the potential for a bad business image and the consequent effects on their business that could result from the public availability of records of non-compliance and sought to avoid such non-compliance as much as they could.

In particular, ‘a clean sheet’ in terms of regulatory inspections by various Port State authorities was regarded as an important measure of the reputation of both the ship management company and the charterer/ship owner. In all cases, the public availability of this information meant that both buyers and suppliers of services could use it as a source of information with which to gauge the quality of ships, their owners and their operators. Indeed, the case studies showed that these measures could be used in both directions in determining potential business relations between buyers and suppliers of services.

In subcontracting the operation of their vessels to Eagle Ship Management, QPR was looking for a ‘quality’ operator with a good reputation. The management at Eagle identified their reputation vis a vis both safety and regulatory compliance as an essential factor in winning the contract to run QPR’s vessels. Equally, however, through the same sources Eagle could make themselves aware of ships with records of poor compliance and thus avoid taking on the management of such ships when seeking new business.

### **Conclusions and some reflection on the limits of influence**

In sum, our study of supply chain influences on OHS management in the cluster of companies involved in container and car shipping, indicated that what contributed most effectively towards driving a culture of safety on-board was a constellation of external influences in which the regulatory environment helped to create business pressures driving both companies and their workers towards compliance in relation to regulated safety management practices. In the container trade, in which the risks for the shippers at the heads

of the supply chains were more remote and arguably less catastrophic than those, for example seen in the oil tanker trade. Supply chains were complex and the power of their influence diffuse. In these situations, the capacity of buyers to exert unilateral influence over health and safety management among the suppliers was weak. Therefore, the role of public regulation and the regulatory inspection of standards of occupational health and safety occupied a relatively high profile in the nexus of external influences on safety practices on-board ships. In particular, the ‘smart’ regulatory strategies adopted by regional associations of regulatory administrations in which enforcement actions taken in relation to ships were made public, helped to create an environment in which knowledge of the availability of this information helped to make supply chain relations important in shaping and influencing the priorities of both ship managers and charters in addressing safety management on-board.

Of course our case study presents a picture of what is likely to be most relevant at the better end of the trade. It is worth digressing for a moment to reinforce this important limitation. The ship on which we sailed and the companies that allowed us access to their management and workers had comparatively good safety records and were striving to meet quality standards in which they regarded this good safety performance as an indicator of success, largely because such standards were perceived by them to be important to the commercial success of their business. A major question remains as to how transferable this practice is and to what extent practices such as the ‘smart’ regulation discussed in the previous section can contribute to driving such transference to other parts of the industry.

Within the maritime industry, as is well known, significant challenges for regulation exist. They arise partly from the global nature of the shipping industry and the complications it creates for the application of national and international laws. These are greatly exacerbated by the highly developed trend towards deregulation pursued by the industry in recent decades, in which ‘flagging out’ has resulted in a major shift of ship registration (and hence regulatory control) from the embedded maritime states to new administrations, many of which have little capacity for regulatory scrutiny. The consequence of this is a highly varied experience of the strength of the institutional framework for regulation in the industry globally. This strength, was evident in the particular situation on which the present study focused and it was a significant factor in the creation of an environment in which supply chain pressures work positively towards enhancing OHS standards. In the absence of such a strong institutional framework however, there is little in our findings to suggest that the market-based business interests that were significant in creating the supply chain leverage on

OHS management that we observed would act in the same way, or on their own be sufficient, to raise and maintain OHS management standards on a significant scale.

The challenge therefore remains one of achieving a stronger and more consistent regulatory framework globally. As such, while our findings show that actors within supply chains can positively influence OHS management conditions in the organisations with which they have relations, they suggest that such effects are most likely to occur in contexts where surrounding institutional pressures serve to create supporting market contexts. That is in institutional contexts where market, and related inter-organisational, logics are importantly shaped by supplemental regulatory and reputational risks. In pointing in this direction, our findings therefore both accord with, and receive support from, conclusions reached following other analyses focussed for example on the adoption of corporate social responsibility policies (Gjolberg, 2009), the facilitators of self-regulatory corporate behaviour (Short and Toffel, 2010), and the limits of forms of private governance (Mayer and Gereffi, 2010). In the maritime context they further endorse the conclusion that while supply chain influences can be important sources of leverage in relation to OHS practices, and constitute a useful driver in enhancing safety in certain situations, they are not a substitute for regulatory standards and do not eliminate the need to further develop stronger and more broad-reaching smart regulatory regimes.

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# Accommodation and Welfare on Contemporary Cargo Ships

*Neil Ellis & Helen Sampson*

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## Abstract

The standard of the facilities and furnishing of accommodation spaces is not only important because seafarers spend much of their lives at sea, but also because land-based research has demonstrated an impact of the built environment on well-being. This paper therefore examines seafarers' current experiences of accommodation and recreational facilities. It reports on a large-scale international questionnaire study conducted in the period 2010-2012. In highlighting the significant variations in accommodation design and standards across the sector the paper highlights the considerable need for this area to be given far greater priority in the commissioning and design of modern vessels.

## Introduction

In the present day shipping industry the romantic image of lengthy shore-leave for seafarers in far flung ports is long gone. The demands of modern shipping mean that vessels are often only in port for a few hours at a time, during which seafarers are generally busy supervising the loading and unloading of cargo, or dealing with the numerous officials who are part of a vessel's visit to port. The modern seafarer has to work long hours and on tours lasting many months, with little chance of getting ashore. In this context standards of on-board accommodation are of particular importance as evidence indicates that the built environment has the potential to cushion the impact of fatigue as well as stress (Maas, *et al.*, 2009; Van de Glind, *et al.*, 2007; Caspari, *et al.*, 2006; Kaplan, 1995). In times of economic turmoil and increasing competition within the industry there are inevitably pressures to cut back on investment in the accommodation areas<sup>1</sup> of ships, and to prioritise cargo carrying capacity and working areas of a vessel. However, such prioritisation is likely to come at a cost in

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<sup>1</sup>This is not always the case, and some owners have gone to great lengths to provide good standards of accommodation. Over the last 15 years researchers at SIRC have identified considerable variation in the standards of accommodation and recreational facilities (Ellis, *et al.*, 2012). For example, some vessels are known to be clean and well maintained with good facilities while at the other end of the spectrum some ships have cramped and uncared for cabins, with meagre recreational facilities.

relation to the effective performance of seafarers and while it is currently largely overlooked this paper will argue that there is an established body of evidence which suggests that accommodation design should be seen as key to the performance and retention of seafarers in the industry.

Land-based studies highlight the impact of the built environment both at home and in work. Factors such as quality of housing (Evans, 2003), noise levels (Salyga and Juozulynas, 2006; Riediker and Koren, 2004), light levels (Kuller, *et al.*, 2006), and colour schemes (Caspari, *et al.*, 2006; Baglioni and Capolongo, 2002) have all been shown to have effects on health and well-being. For example, good quality interior furnishings and decor have been positively linked to wellbeing, mood and behaviour (Kuller, *et al.*, 2006; Caspari, *et al.*, 2006; Baglioni and Capolongo, 2002). In a vocational setting Caspari also suggests that ‘high quality working conditions reduce stress factors, strengthen immunity, and heighten the contentment factor’ (Caspari, *et al.*, 2006). Other research shows that aesthetically pleasing surroundings may increase recovery rates from mental fatigue (Evans, 2003).

It is reasonable to extrapolate from these land-based findings that accommodation design, noise levels, light levels and other aspects of the built environment equally impact on seafarers and their health and wellbeing. Poor quality accommodation and recreational facilities are also likely to influence seafarer retention rates. Thus the study of seafarer experiences of vessel accommodation may be seen as timely<sup>2</sup> in the current climate where some owners/managers are struggling to find good quality well-trained crew for their ships (Tingyao Lin, 2013; Lowery 2012; Matthews, 2010).

This paper therefore presents some of the findings from a study of vessel accommodation undertaken by The Lloyd’s Register Educational Trust Research Unit (The LRETRU)<sup>3</sup>, at the Seafarers International Research Centre (SIRC), which looks at the standards of current accommodation and recreational facilities in the merchant fleet. For the full report see Ellis, *et al.* 2012.

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<sup>2</sup> While Tomaszunas, et al. (1997) in a survey of Polish seafarers looked at satisfaction with accommodation, the main focus of their research was to look at working conditions, morbidity and injury at sea, with standards of accommodation being examined in little depth. A more recent survey of accommodation and recreational facilities on-board commercial yachts has been conducted at SIRC (see see Bailey, et al., 2010). However, due to the specialised nature of commercial yachts it is inappropriate to make comparisons.

<sup>3</sup> On 1 March 2013 The Lloyd’s Register Educational Trust was assimilated into the Lloyd’s Register Foundation. For further information please visit their website [www.lrfoundation.org.uk](http://www.lrfoundation.org.uk).

## Methods

A questionnaire survey was used to examine active seafarers' experiences of accommodation and recreational facilities on-board their current or most recent vessel. The questionnaire was adapted from one used in a study of accommodation and recreational facilities on-board commercial yachts (see Bailey, *et al.*, 2010). This was modified for use with the merchant fleet following pre-pilot interviews conducted at shipyards in China, and after discussion with industry experts. It was then piloted with a small group of seafarers, after which minor changes were made relating to their comments and feedback. The questionnaire included questions about a number of aspects of life and work at sea including: seafarers' demographics, information about the last/current vessel worked on, terms and conditions of employment, working patterns, shared accommodation, experience of cabins, messrooms/crew lounges, washing/drying facilities, shore-leave, recreation facilities on-board, food, concerns about working at sea, and the benefits of working at sea. The final version of the questionnaire was produced in three languages to facilitate accuracy and accessibility: English, Chinese (Mandarin), and Tagalog.

Questionnaires were distributed and collected by researchers at maritime colleges, training centres, and Seafarers' Missions in three countries: China, Philippines, and the UK. Anonymity and confidentiality were assured at all times.

1,533 questionnaires were completed and returned in total, and results from these were then entered into the computer based statistical analysis package SPSS18. Chi squared analysis was used to test for statistical differences in reported experiences of accommodation and recreation facilities on-board, using a significance level of 0.05. Within this paper only significant findings are discussed.

## The sample

Only two percent (n=30) of the sample were women, and the average age of respondents was 33 years old (ranging from 17 to 73 years old)<sup>4</sup>. The sample consisted of four main nationalities, mostly reflecting the countries in which the questionnaires were distributed. The largest nationality groups were Filipinos (39%) and Chinese seafarers (32%). Indian seafarers

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<sup>4</sup> Age is split up into five age groups: 25 year old or less, 25-29 years old, 30-34 years old, 35-39 years old, and 40 years old and over.

made up the next most frequently represented nationality group (15%) followed by British seafarers who represented 12% of the sample. All other nationalities (combined) represented just 3% of the sample overall<sup>5</sup>. In terms of rank senior officers accounted for 24% of the sample, junior officers 42%, and ratings 34%. The majority of seafarers had worked at sea for less than 11 years (67%), and only 6% had been at sea for over 20 years.

In terms of the vessel types the most frequently represented ship types were bulk carriers (31%) and tankers (27%), followed by slightly lower percentages (23%) of specialist cargo/general cargo/container vessels (see Figure 1). Passenger carrying vessels and ‘other’ vessel types<sup>6</sup> represented a smaller percentage of the overall sample (8% and 11% respectively). The mean gross tonnage of the vessels was just under 40,000gt (39,264.62gt)<sup>7</sup>, and the average age of vessels was 10 years old<sup>8</sup>. The majority of ships were built in Japan (33%), China (23%) and South Korea (17%), generally reflecting shipbuilding trends in the world over the last thirty years<sup>9</sup>. When the sample was compared to the world fleet as listed in *Lloyd’s Register Fairplay World Fleet Statistics (2011)* the current sample over-represented bulk carriers and to a lesser extent tankers, and under-represented ‘other’ ship types. Older ships were also seen to be under-represented (For full details of these comparisons see Ellis, *et al.*, 2012).

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<sup>5</sup> These other nationalities are grouped together and are referred to as ‘other’ in all subsequent analysis.

<sup>6</sup> ‘Other’ vessel types are those that did not fall into the four main ship type categories.

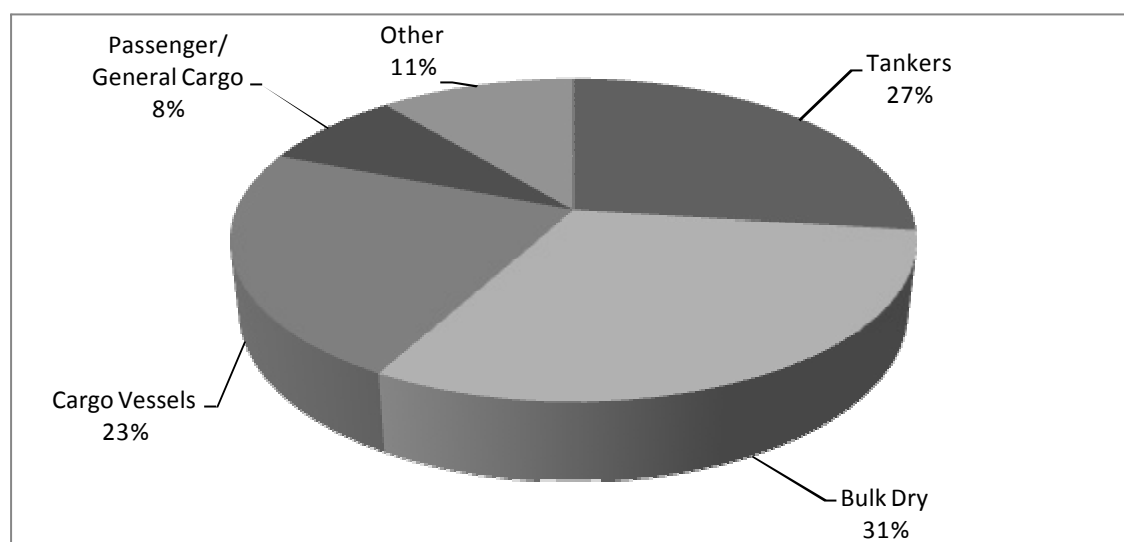
<sup>7</sup> Gross tonnage is used as an indication of size within this study, with vessels split into small, medium and large ship groupings, irrelevant of ship type.

<sup>8</sup> For all subsequent analysis ships are split into four age groups: less than 5 years old, 5-9 years old, 10-19 years old and over 20 years old.

<sup>9</sup> Ships not built in the three main countries (Japan, China, South Korea) are grouped together and referred to as ‘others’ in following analysis.



*Figure 1: Ship Types*



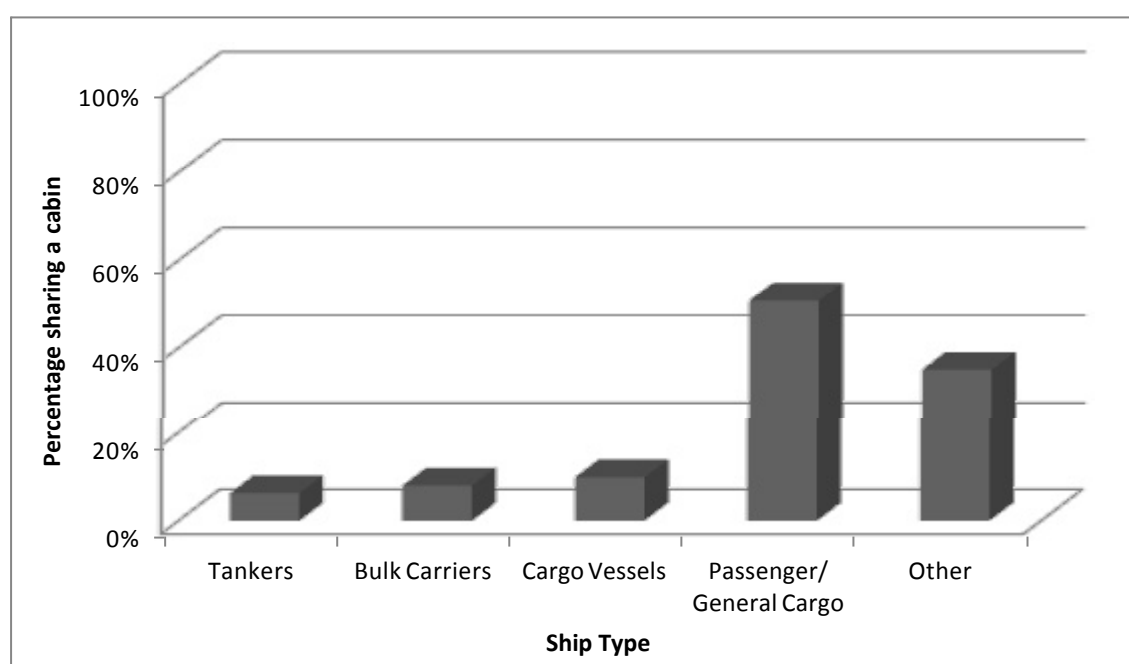
## **Results**

### *Sharing a cabin*

Although the majority (86%) of seafarers indicated that they did not share a cabin, of the 14% that did, 86% said they did not have a choice about sharing, and the majority of these indicated that they minded sharing a cabin. Twenty-one percent of those that shared a cabin reported that they minded sharing 'a great deal', and only 7% indicated that they 'did not mind sharing'. Not surprisingly it was younger seafarers (those under 30) who were more likely to be sharing a cabin, and ratings were also more likely to be sharing than officers.

In terms of vessel characteristics, type of vessel was found to have a significant impact on whether seafarers shared a cabin or not. On passenger/general cargo ships a high proportion of seafarers (51%) were found to be sharing cabins, with only a small proportion of seafarers sharing a cabin on the other main vessel types (6% tankers, 8% bulkers, 10 % cargo vessels, see Figure 2). The percentage of seafarers sharing a cabin in the 'other' ship type group was higher at 35%, although it is difficult to draw any conclusions about this group as it consists of a varied range of vessels.

*Figure 2: The Percentage of Seafarers Sharing a Cabin by Ship Type*

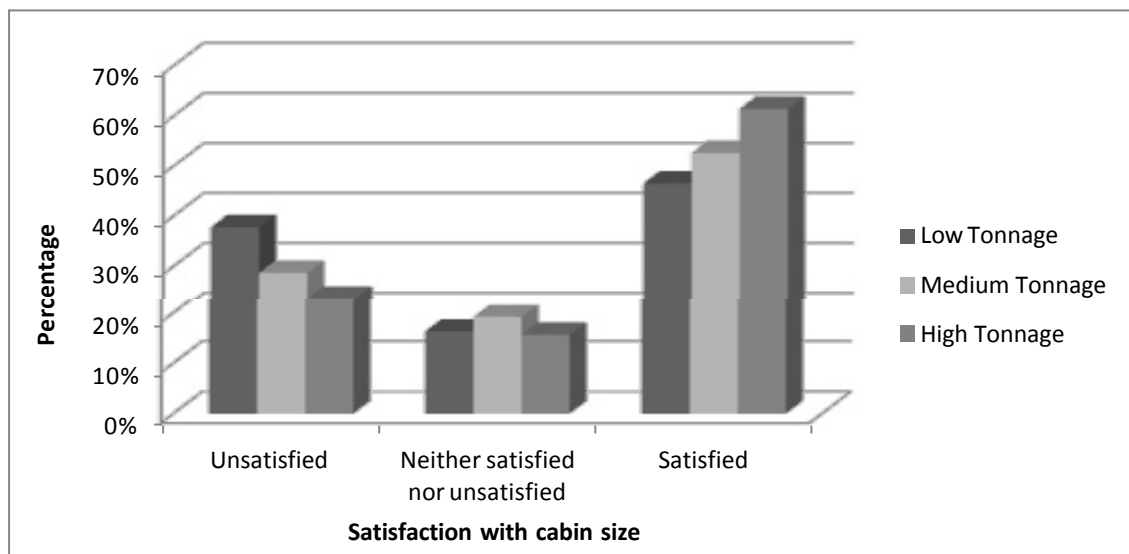


Those working on older and smaller ships, as well as those vessels built in China and ‘other’ countries were also more likely to be sharing a cabin.

### *Cabin size*

When seafarers were asked about the size of their cabins, almost a third (30%) indicated that they were ‘unsatisfied’ or ‘very unsatisfied’ and just over half (54%) suggested that they were ‘satisfied’ or ‘very satisfied’. Surprisingly, although higher ranking seafarers (i.e. officers) would generally be expected to have larger cabins, they were generally more dissatisfied with the size of their cabins than ratings, and junior officers were more dissatisfied with the size of their cabins than senior officers. In terms of differences relating to ships, seafarers on tankers and passenger/general cargo vessels were more frequently satisfied with the size of their cabins than those on bulk carriers. Country of build was also an important factor and seafarers on vessels built in South Korea and ‘other’ countries were more satisfied with the size of cabins than those working on vessels built in Japan and China. Seafarers on larger vessels were also significantly more satisfied with the size of their cabins (see Figure 3).

Figure 3: Satisfaction with Cabin Size by Ship Size



### Storage space

In terms of storage space within cabins a similar picture was found. Thirty-four percent of seafarers indicated that they did not have sufficient storage space. Again it was junior officers who were least satisfied with storage space and 39% suggested that they did not have sufficient storage space compared with 36% of senior officers, and 27% of ratings.

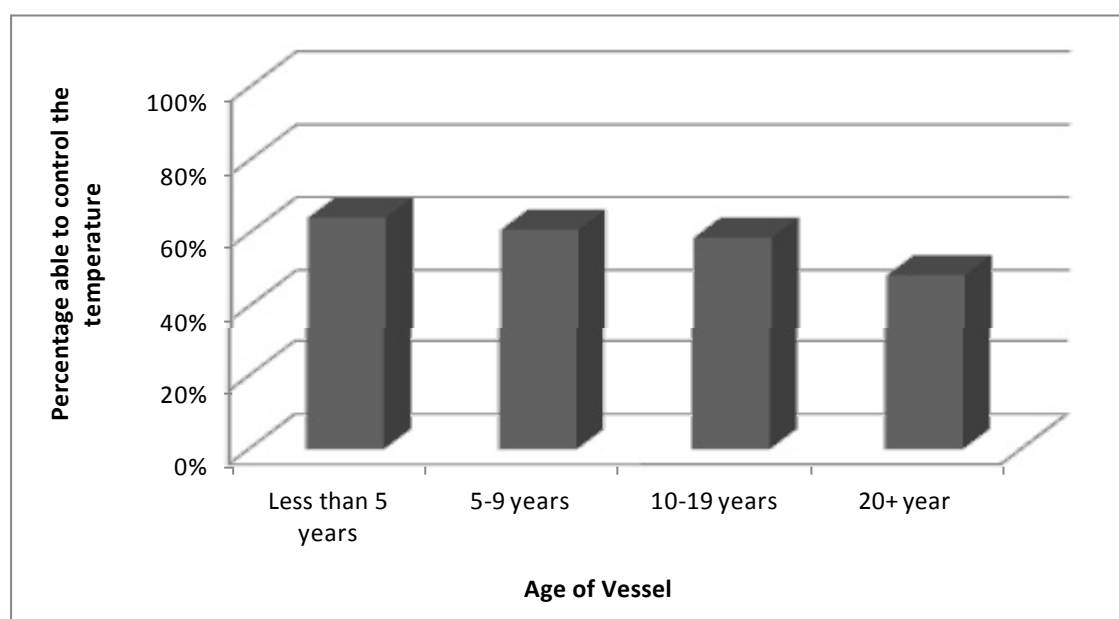
Vessel size was important. Seafarers working on larger vessels were more satisfied with storage space than those on smaller vessels. Seafarers working on ships built in South Korea were also more satisfied with storage space than those working on ships built in China or Japan.

### Cabin temperature

Forty-one percent of seafarers indicated that they were unable to control the temperature in their cabins. Interestingly it was senior officers and ratings that were significantly more likely to suggest that they could control the temperature within their cabins. Although this finding may be unexpected, it could relate to the fact that senior officers have more general control over the shipboard environment (i.e. the setting of heating/air-conditioning systems on-board), whereas given the length of their contracts ratings may have a habit of bringing external electrical appliances (such as heaters/fans) on-board with them in order to regulate temperature. However this remains supposition as we have insufficient information to venture a more robust explanation.

Ship-type was also an important factor influencing whether seafarers could control the temperature in their cabins. Seafarers working on passenger/general cargo ships and those on newer vessels were more likely to be able to control the temperature in their cabin (see Figure 4).

*Figure 4: The Percentage of Seafarers Who Were Able to Control the Temperature in their Cabin by Age of Ship*



### *Light in cabins*

Just over half (52%) of the seafarers in the survey were unable to control light levels in their cabins. Thirteen percent of these described light levels as too bright, and 14% described them as too dim. Filipino seafarers were most likely to say that they were able to adjust light levels. There was also an influence of rank, and senior officers and ratings more frequently stated that they could adjust light levels than junior officers. The ability to adjust lighting in cabins was not influenced by any vessel factors (i.e. vessel type, age, country of build or size).

In terms of natural light, 10% of seafarers indicated that they did not have a window/porthole in their cabin which allowed natural light in. Nationality and rank differences were found, and Filipino seafarers and ratings were less likely to have natural light in their cabins.

### *Noise in cabins*

Nearly two thirds of seafarers reported that they were disturbed by noise in their cabin at least some of the time, and 20% suggested that they were disturbed by noise ‘all of the time’. Of those disturbed by noise in their cabin some of the time, 29% were disturbed both at sea and in port, 30% at sea only, and 33% in port only. Chinese seafarers were most likely to suggest they were disturbed by noise in their cabins, and Filipino seafarers were least likely to say they were disturbed by noise. In terms of rank, it was officers that were most likely to be disturbed by noise.

The type of ship seafarers were working on also had an impact on whether they were disturbed by noise: those on general cargo vessels were most frequently disturbed by noise (68%), compared to bulk carriers (62%), passenger/general cargo ships (53%), and tankers (51%). Seafarers on ships 20 years of age, or older, were also slightly more likely to report being disturbed by noise, as were those working on ships built in China.

### *Vibration*

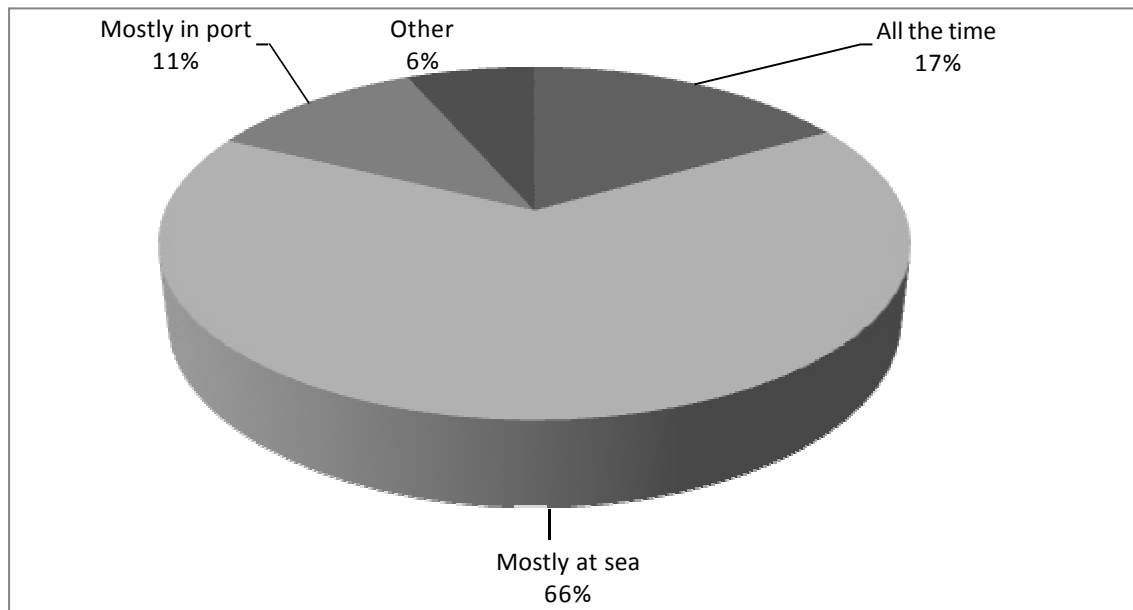
As with noise, a high percentage (63%) of seafarers indicated that they were disturbed by vibration in their cabins. This disturbance occurred mostly at sea (66%). Eleven percent of seafarers were disturbed in port and 17% were disturbed by vibration both in port<sup>10</sup> and at sea (see Figure 5). Chinese seafarers and officers (both senior and junior) were more likely to report being disturbed by vibration, and ratings and Filipino seafarers were least likely to report being disturbed by vibration.

As with noise, ship type again affected whether seafarers were affected by vibration. Seafarers working on cargo vessels (68%) and on bulk carriers (67%) were most likely to report being disturbed by vibration. Seafarers working on ships built in China were also more likely to report being disturbed by vibration (70%), and those working on ships built in Korea were least likely to report being disturbed (52%).

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<sup>10</sup> Probably as a consequence of cargo operations.

*Figure 5: The Times When Seafarers Were Disturbed by Vibration*



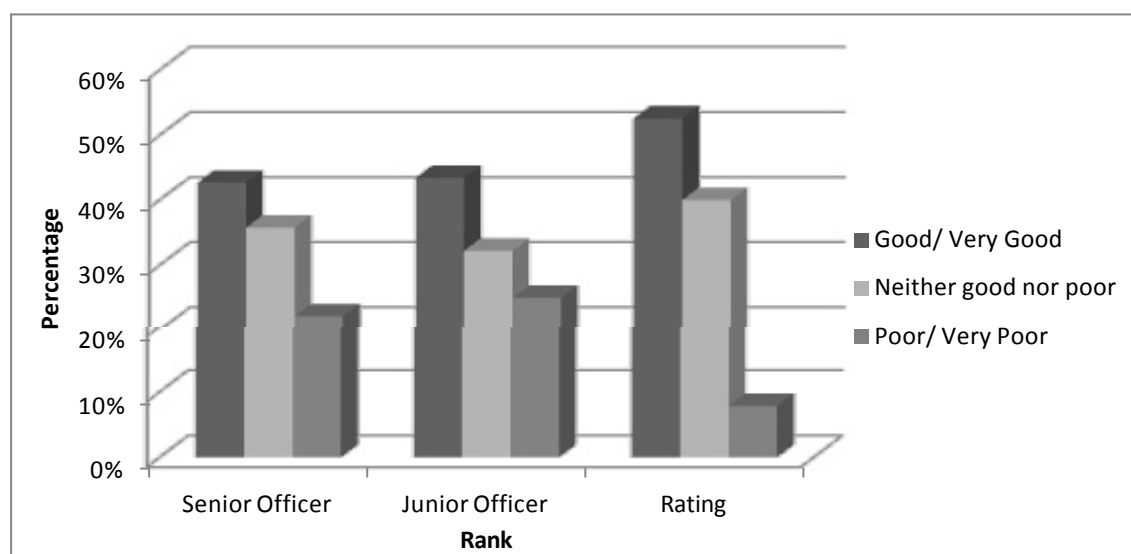
#### *Quality of rest*

Fifty-nine percent of seafarers reported that they could only get adequate rest 'some of the time' and a further 19% stated that they could not get adequate rest 'very often' or 'at all'. This leaves just under a quarter of the seafarers included in the study reporting adequate rest. Of those that did not get adequate rest 'very often' or 'at all', 21% said this was a problem at sea, 44% a problem in port, and 35% a problem both at sea and in port. The only vessel related factor that had an effect on rest was age of vessel. Seafarers on the youngest vessels (five years or less) reported getting adequate rest more frequently than those on older vessels.

#### *Standard of furnishing*

When seafarers were asked about the standard of furnishings in their cabins, just under a half described them as 'good' (42%) or 'very good' (5%), with a significant number (36%) describing them as 'neither good nor poor', and nearly a fifth (18%) describing standards as 'poor' or 'very poor'. Officers and Chinese seafarers were more likely to suggest the standard of the furnishings was poor/very poor (see Figure 6).

Figure 6: Rating of the Standards of Furnishings by Rank



In terms of ship-related factors, ratings of furnishing improved as ship size increased, but decreased as vessels got older. Standards of furnishing were rated more favourably on vessels built in South Korea and in ‘other’ countries, compared with those built in China or Japan. Furnishings were also seen as better on tankers and passenger/general cargo ships than on bulk carriers where satisfaction levels were low (only 37% rated furnishings as ‘good’ or ‘very good’ aboard bulk carriers).

In terms of the condition of the furnishings, the vast majority of seafarers indicated that the furnishings and facilities in their cabins were clean and in a reasonable condition (85%). Officers and Chinese seafarers were more likely than other groups to report that the furnishings were poor/dirty. Age, country of build, and ship type all influenced ratings of cleanliness. Seafarers working on tankers most frequently suggested their cabins were clean and well maintained (93%), and those working on cargo vessels and bulk carriers reported clean/well maintained cabins less frequently (81% in both cases). Those on older vessels more frequently suggested furnishings were poor/dirty, as did those on Chinese and Japanese built vessels.

### *Cabin facilities and provisions*

Seafarers were asked about a broad range of fittings and provisions in their cabin. Most seafarers reported being provided with at least basic facilities/amenities, such as bedding, drawers, wash basins, reading lights, toilet paper, towels and soap (see Figure 7). Some amenities were less frequently provided: 30% of seafarers reported having TV in their cabin, 17% reported the provision of a radio and 19% reported the provision of a music system. Only 15% indicated that internet access was provided in cabins.

*Figure 7: The Facilities Provided Within Cabins*

| <b>Facility</b>   | <b>Percentage of seafarers who had facility</b> |
|-------------------|-------------------------------------------------|
| Bedding           | 98%                                             |
| Drawers           | 96%                                             |
| Table/desk        | 95%                                             |
| Toilet paper      | 94%                                             |
| Soap              | 94%                                             |
| Towels            | 93%                                             |
| Wash basin        | 90%                                             |
| Reading light     | 85%                                             |
| Wardrobe          | 80%                                             |
| Comfortable chair | 76%                                             |
| TV                | 30%                                             |
| Music system      | 19%                                             |
| Radio             | 17%                                             |
| Internet access   | 15%                                             |

The provision of cabin amenities was seen to be influenced by a number of ship-related factors. Those on larger vessels were more likely to be provided with reading lights, tables/desks, wash basins, towels, and comfortable chairs. Those working on older ships were more likely to have radios in their cabins, whereas those on newer ships were more likely to be provided with comfortable chairs, reading lights, internet access, wash basins, toilet paper, and drawers in their cabins. The type of vessel seafarers were working on also influenced the facilities provided. Those on passenger/cargo vessels and ‘other’ vessel types were more likely to have electronic appliances provided, such as TVs, radios, music systems, and internet access whereas those on bulk carriers were the least likely to have internet access in their cabins. Vessels built in countries other than the three main countries of build (i.e. South Korea, China, or Japan) were much more likely to have internet access, TVs, radios and music systems.



### *Messrooms/lounges*

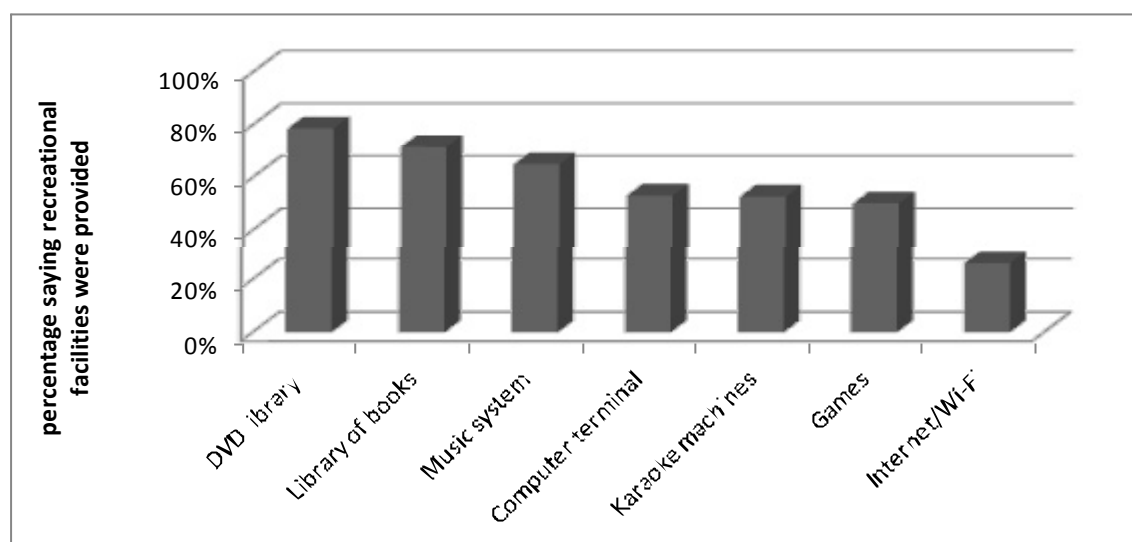
The vast majority of ships that seafarers were sailing upon had messrooms/lounges on-board (97%). Where common messrooms were provided these were significantly more likely to be on smaller ships. In terms of what was provided within messrooms/lounges most seafarers indicated that the following were provided: tables and chairs (98%), television (94%), films/DVDs (87%), and fridges (88%). Drinking water (83%), hot drinks facilities (76%), and radio/CD players (70%) were less frequently provided. However, by quite a considerable margin, the least frequently provided amenity was found to be comfortable chairs. These were reported to be provided by just 66% of seafarers.

Looking at vessel characteristics, comfortable chairs and radio/CD facilities were most likely to be provided on larger vessels. General cargo ships least frequently had comfortable chairs for relaxing, hot drinks facilities and drinking water provided in messrooms/lounges whereas tankers were more likely to have films and DVDs, and radio/CD facilities provided. 'Other' ship types and passenger/general cargo vessels were more likely to have comfortable chairs for relaxing, hot drinks facilities, and drinking water. Refrigerators were least likely to be found in the messrooms/lounges of passenger/general cargo vessels. Vessels aged between 5-9 years old seemed to have the best provision of messroom/lounge facilities.

### *Recreational facilities*

The most commonly provided recreational facilities on-board were DVD libraries which were provided in 78% of cases (see Figure 8), followed by books (71% of cases), and less frequently music systems (65%), computer terminals (53%), karaoke machines (52%), and games (50%). The least common recreational facility was internet access/Wi-Fi, provided in only 26% of cases (access to the internet is discussed in more detail later).

Figure 8: Recreational Facilities Provided On-board



Music systems, DVD libraries, and karaoke machines were more frequently found on tankers, and were least often found on passenger/general cargo vessels. On these ships the most frequent recreational facilities were internet/Wi-Fi and games. Larger vessels were more likely to have music systems, karaoke machines, games, DVD libraries and book libraries than smaller vessels. Ships built in South Korea were the best equipped in terms of recreational facilities with music systems, karaoke machines, games, DVD libraries and book libraries more frequently found on-board.

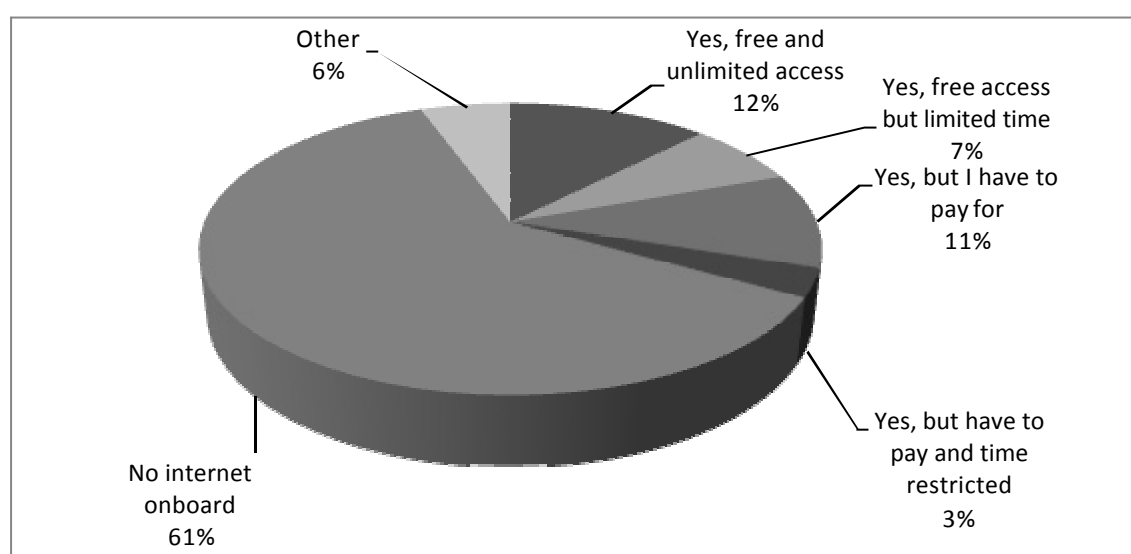
Seafarers were also asked if there were any facilities they would like on-board that were not currently available. By far the most frequent answer, suggested by 66% of seafarers, was that they would like access to the internet/Wi-Fi on-board. The next most frequent answer, suggested by 17% of seafarers was a gym, with the third most popular choice being telephone access (7%), or access to games 1 (7%). Also listed were: satellite TV (5%), computer terminals (3%), and a swimming pool (2%)<sup>11</sup>.

<sup>11</sup> Here it is likely that many seafarers are tailoring their responses according to their view of what they might expect companies to agree to provide. Thus it is likely that far more than 5% of seafarers would appreciate satellite TV on-board but that most seafarers think companies are unlikely to ever provide this. A similar interpretation is plausible with regard to computer terminal provision and provision of a swimming pool.

## Internet Access

When seafarers were asked if they had internet access on-board, nearly two thirds (61%) indicated that they had no internet access at all (see Figure 9). Twelve percent of seafarers had free and unlimited access to the internet, and the remaining seafarers reported access with some form of restriction, such as with the need for the Captain's permission, time limitations, or having to pay (see Figure 9). Seafarers with free and unlimited access were more likely to be from the Philippines and the UK.

Figure 9: Internet Access



Those on 'other' vessel types most frequently had free and unrestricted internet access (34%), followed by those on tankers (20%). Only three percent of seafarers working on bulk carriers had free and unrestricted access to the internet. The ability to access the internet was more frequently found on modern vessels, with access declining as vessels got older. Access to the internet was also more likely on vessels built in 'other' countries where 22% of seafarers reported free and unlimited access to the internet. In contrast 79% of those on Japanese vessels reported no access at all to the internet, and only 5% reported free or unlimited access.

### *Email Access*

Access to email facilities was generally better than access to the internet. However, 41% percent of seafarers indicated that they were not able to send or receive emails on-board ship. Seafarers without access to email facilities were more likely to be Chinese.

Just over a quarter (27%) of those that could send/receive emails had free and unlimited access to email facilities. These seafarers were more likely to be from the Philippines and the UK. Twenty-eight percent of seafarers reported access to email facilities with some restrictions, such as the need for the Captain's permission, time limitations, or having to pay. For seafarers that had to pay for access the average cost was 11.89 US dollars per hour.

Seafarers on 'other' ship types most frequently reported unlimited access to internet facilities (51%). Those on cargo vessels and passenger/general cargo ships had much more restricted access with only 24% and 20% respectively having unlimited access. However, for those on bulk carriers the situation was even worse and only 12% reported free and unlimited access to email. Email access was more frequent on larger vessels (63%), and on those built in South Korea and 'other' countries. In terms of vessel age, those on 5-9 year old vessels more frequently had access to emails, compared to both older and younger vessels.

### *Telephone access*

Although 97% of seafarers reported that they took a mobile phone on-board with them, they were only able to get a signal on an average of 15.1 days per month. Seventy-four percent of seafarers had access to the on-board telephone, but with some limitations. Limitations included: requiring permission from the Captain (15%), having to pay (53%), or limited time allowed (6%). Only three percent of seafarers had free and unlimited access to the ship's telephone and one in five seafarers reported no access at all. Seafarers without any telephone access were more likely to be Chinese seafarers. For those seafarers that had to pay for access to the telephone, the average cost was 43.12 US dollars per hour.

The type of ship seafarers were working on influenced access to the telephone. Twenty-six percent of seafarers on cargo vessels had no access to a telephone at all, compared to 9% of those on tankers. Those on larger vessels were more likely to have some sort of access to a telephone, although those on smaller vessels were more likely than other groups to have free or unlimited access to the telephone. Access to the on-board telephone also reduced with

increases to the age of the ship. Those on ships built in South Korea more frequently had access to the telephone (95%), compared to those built in Japan (77%) and China (74%)

## Conclusions

This research indicates that while most seafarers had single occupancy cabins, these were frequently regarded as too small, lacking in storage space, and offering seafarers insufficient control over their environment (in terms of cabin temperature, light levels, noise and vibration). The standard of cabin furnishings was also unsatisfactory in a small but significant number of cases. Although, on the whole, a broad range of fittings and furnishings were provided in cabins, facilities, such as reading lights, wardrobes and comfortable chairs were less frequently supplied. Other more advanced electronic equipment such as the TVs, radios, or music systems that we take for granted in our homes were provided in only a very small percentage of cases.

Whilst it may be argued that there are a number of constraints relating to seafarer accommodation, the research suggests that there are considerable variations in provision across the fleet which illustrates that in many cases more could be done to provide a reasonable living environment. Shore-based studies have demonstrated that decent living conditions improve restoration from stress and fatigue and may also have positive effects on health and well-being (Maas, *et al.*, 2009; Van de Glind, *et al.*, 2007; Caspari, *et al.*, 2006; Küller, *et al.*, 2006; Riediker and Koren, 2004; Evans, 2003; Kaplan, 1995). Further to this it is worth emphasising the importance of communal facilities and the provision of recreational amenities for seafarers. The research indicated that more could be done on this front even in relation to basics such as the provision of comfortable seating to encourage seafarers to make use of communal messrooms and lounges. Shore-based research findings demonstrate that socialisation is likely to positively impact upon mental and physical health (see Maas, *et al.*, 2009; Leventhal & Brooks-Gunn, 2003; Kawachi, 1999) yet there seems to be very little consideration given (by ship operators) to means of encouraging such socialisation on-board.

Finally, we should emphasise the importance of access to affordable, regular, communication with families ashore. A wealth of research supports the notion that such access should be a priority for vessel operators. Like their shore-based colleagues, seafarers benefit from some kind of work life balance and this can only be achieved where they can maintain connections

ashore and quickly reintegrate into their communities during periods of leave. Regular communication with families has been shown to be key to such reintegration (see for example Sampson, 2013) and furthermore families and friends can offer seafarers important social support whilst they are at work (see Chan and Lee, 2006; Franzini, *et al.*, 2005; Cohen, 2004; Berkman and Syme, 1979).

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